SCIENTIFIC AMERICAN

[Entered at the Post Office of New York. N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION. ART. SCIENCE. MECHANICS. CHEMISTRY AND MANUFACTURES.

Vol. XLV.—No. 26. [NEW SERIES.] NEW YORK, DECEMBER 24, 1881. [$3.20 per Annum. [POSTAGE PREPAID.]

PROPOSED NEW SYSTEM OF WATERWORKS FOR CHICAGO.

We have received a copy of the proposal made, September 10, 1881, by Mr. Wm. Golding, M.E., of New Orleans, La., to the Board of Public Works of Chicago, for the erection of new pumping machinery for the waterworks of that city. This proposal is accompanied by engineering drawings, and taken altogether is quite a remarkable document, reflecting much credit upon the author. It illustrates a system that contains points of unusual practical excellence coupled with great simplicity and economy of construction. In our opinion it deserves the attention of hydraulic engineers and water directors in all parts of the country. The first general requisite of a good water delivering mechanism is thorough efficiency in doing its work; next, such a simplicity of construction that any moderately equipped foundry or shop can manufacture the machinery or enlargements when required, while any ordinarily intelligent engineer can set up the same and easily keep it in effective operation. All these features are fully realized in Mr. Golding's system, and will commend themselves to engineers.

In view of these considerations we have thought that our readers would be interested in the following brief review of the salient features of the system, which, with our engraving, we derive from the printed proposal before mentioned.

The general ideas of the author in designing this system are well set forth in his preface; some of them may provoke discussion; but the more they are discussed the better. They are substantially as follows:

"Principles were created with the earth. The utilization of principles forms the various branches of science. To separate and convey material is allotted to mechanics. In moving a quantity of material an equivalent is expended, which equivalent is denominated power. The mechanical combination for conveying material will be appreciated in the proportion as the useful work performed approximates the power expended. When a unit of power is expended, a unit of work is performed, but not always desirable or useful work, as, for instance, in faulty or inappropriate design, the combination may absorb largely of the power which it is intrusted to transmit.

"When a quantity of water is to be elevated, a very large combination of two or more pumps may be selected, which, as usual and proper in such design, will make but few strokes or repetitions per minute to accomplish the desired result, and will require the entire flow to and from the pumps to be started and checked at each repetition and so absorb much power, which waste of power may be obviated by adopting

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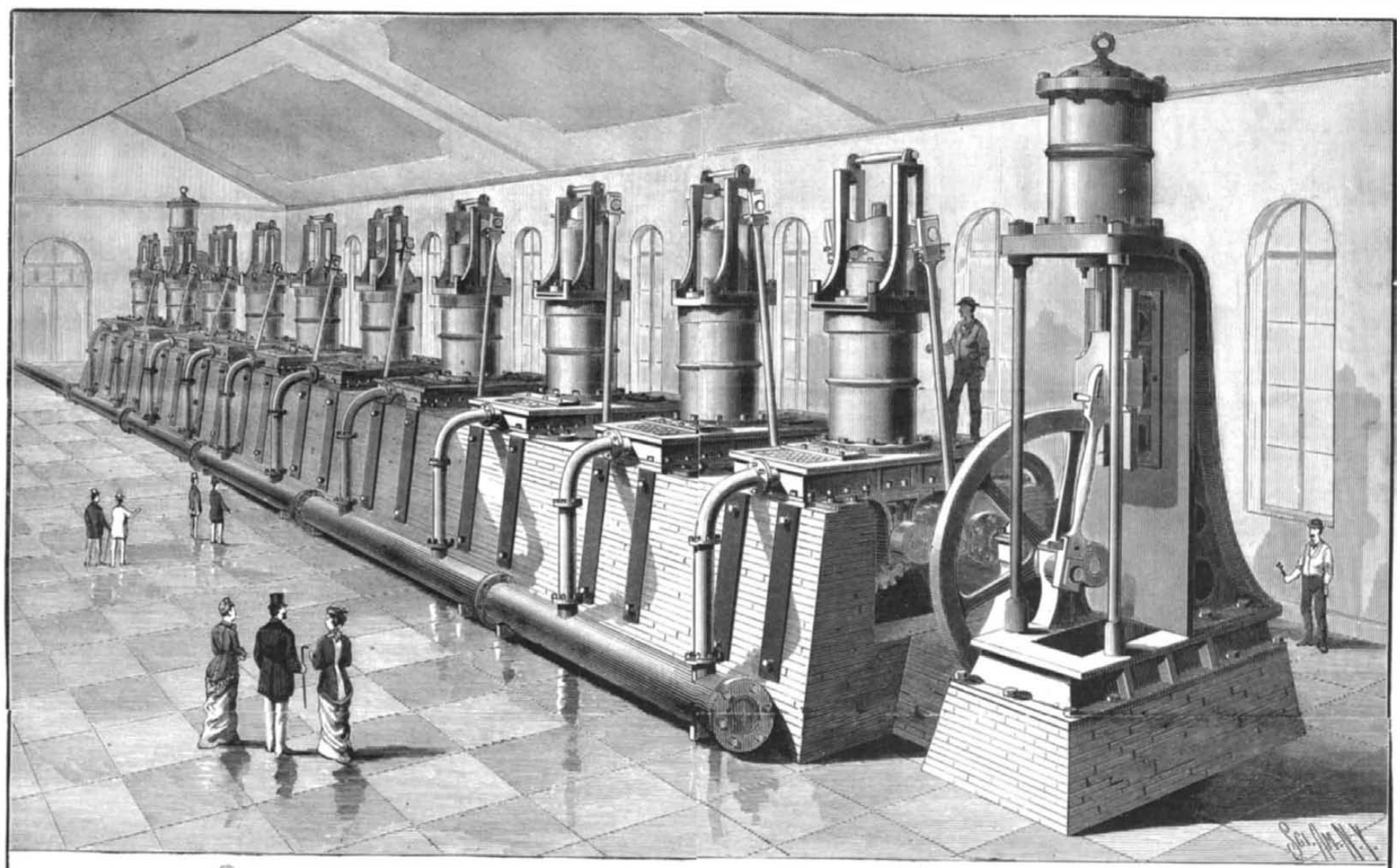

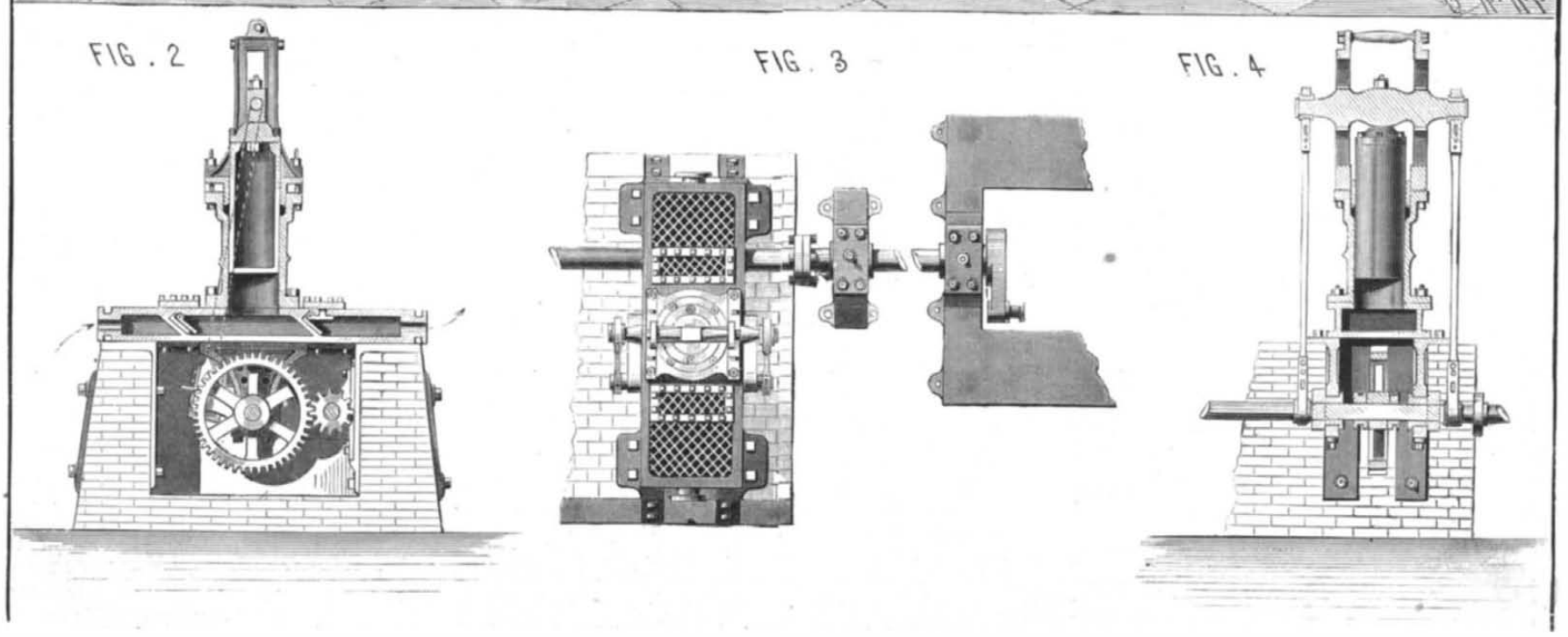

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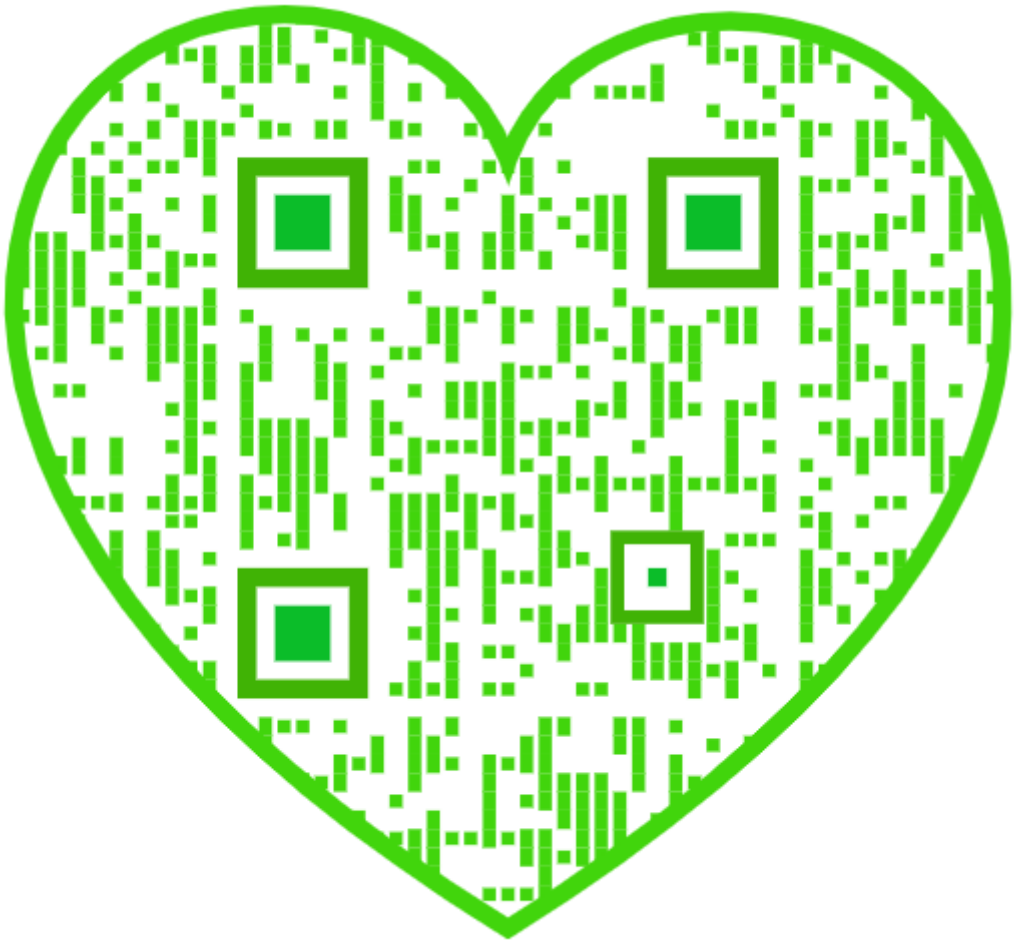

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, DECEMBER 24, 1881.

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A GLANCE BACKWARD AND FORWARD.

As we approach the end of another twelvemonth the usual questions arise: What has been the character of the year's events? What its progress? What its promises?

Naturally those things which bear most directly and forcefully upon a man's life and study and daily labor will seem to him to be the most important. The business man, the engineer, the artisan, the student, the inventor, will each review the past or contemplate the future in his own way, by the light of his individual or professional experience and hopes.

But there are events, achievements of labor, discoveries, inventions, and the like, which all men make note of sooner or later, and which give to the year its historic character. Who can name those of the year just closing?

The task would not be so hard if each year stood alone in its work or measurably distinct, like the links of a simple chain; or if it were possible for men to pick out infallibly from the complicated tissue of current events those most worthy of commemoration. But the great work which was brought to fruition this year was begun perhaps a decade, perhaps a century ago. The invention, observation or discovery by which the year 1881 will be best known a century hence is most probably yet unreported or hid away in the mass of the year's records, with its importance unsuspected or at best but vaguely recognized, even by the man whose name it will make known to many generations. Our point of view is so close that we cannot well see the things our descendants will see most plainly when the things we now magnify most will, perhaps, have gone to the limbo of forgetfulness.

Of some things, however, we may be sure; and, though we may forget them next year, they have played a prominent part in the current history of the past four seasons.

Of one thing we can speak with confidence. Though not the best of years, 1881 will go down to history as certainly not an empty or a bad one. Crops have been fairly good the world over. There have been no great famines, no widespread plagues, no devastating wars. The industriously inclined have had enough to do everywhere, and in our own country, at least, have been able to command an average amount of the mental and material good things going.

Our industries, on the whole, were probably never more flourishing, more varied, or more reasonably hopeful as to the future. There have been no general disturbances of labor nor anything tending to throw large numbers of men and women out of employment. Commercial failures have been comparatively few, and every productive industry has thriven. In many departments the work already called for and undertaken is sufficient to insure steady employment for men and machinery for several if not all of the months of the coming year.

The rapid extension of our railway system, in the older States as well as in the newer Territories, has given and doubtless will continue to give employment to vast armies of out-door laborers and scarcely smaller armies of machinists, mechanics, iron and steel makers, and workmen in all the arts tributary to the railway system.

The industrial development of the South, Southwest, and Northwest during the year has been unprecedented, vast acres of virgin and long neglected soil having been brought under cultivation, vast stores of natural wealth in forest and mine having been newly opened up and made accessible by new roads.

As the commercial and financial center of the country, and now, as the late census has shown, the manufacturing center also, New York naturally feels intensely the quickening pulse of general activity. An index of the impetus of national prosperity, we have seen in this city and across the river in Brooklyn over four thousand houses begun and many completed during the eleven months of the year already passed, not a few of these structures covering large areas eight or ten stories high. The estimated cost of the buildings for which permits were granted during the first eleven months of the year exceeds fifty-five million dollars.

The lighting of our streets and squares by electric lamps was officially begun less than a year ago. The work of putting down mains for the conveyance of electric conductors for a general system of incandescent electric lighting for stores, offices, and dwellings is going on rapidly. And the same may be said of mains for steam heating from central stations.

The great bridge across the East River is nearing completion. The year has seen the approaches substantially finished and the work on the superstructure begun. Now nearly all the floor beams are laid. The original plans have been materially changed during the year, making the bridge five feet wider and four feet higher above the river, with greatly increased strength, to enable it to carry railway trains of Pullman cars.

The tunnel under the Hudson is progressing rapidly and securely by improved methods, work going on from both shores. Steady progress is also making in the excavations under Hell Gate for the removal of Flood Rock. Safety in the navigation of our harbor and adjacent waters has been largely enhanced during the year by the introduction of iron hulled passenger and excursion steamers.

In marine engineering the most notable progress has been seen in the building of steamships exceeding 5,000 tons and up to 8,000 tons, and in the substitution of steel for iron, as in the construction of the Servia. On the destructive side we have seen the successful testing of the Ericsson torpedo boat Destroyer, the less successful testing of the Alarm, and the launching of some notable torpedo-boats in England.

Besides the work of civil engineering already noticed are several more or less important ones, begun or completed, which should not be forgotten. Another line of railway communication across the great West has been completed in the Southern Pacific road, and rapid progress has been made toward the completion of the Northern Pacific. Canada has undertaken a rival transcontinental railway still further north, and has done considerable serious work upon it during the year. Our northern neighbor has also completed the improvement of the Welland Canal, a work lately pronounced by high authority to be the best of its kind in the world. Our southern neighbor, Mexico, has manifested unwonted activity in railway extension, and unwonted wisdom in greeting cordially American enterprise therein, and in the Tehuantepec ship railway scheme of Capt. Eads. At Panama the De Lesseps canal project has been seriously begun, surveys and some excavations have been made, and a heavy tribute paid to the evil genius of the climate in death and disease among the engineering staff and the small army of laborers employed. The St. Gothard Tunnel through the Alps has been opened to traffic, and the projectors of the English Channel Tunnel have given earnest of their sincerity in steady and promising work in actual drifting under the sea. The new Eddystone Lighthouse has been completed. The centennial of the birth of George Stephenson has been duly celebrated in England, and duly commemorated in this country by a commendable advance in the speed of fast trains between our principal cities. Though built last year, the Fontaine locomotive makes its mark by actual service this year.

Not the least notable characteristic feature of the year has been the increasing attention given to useful applications of electricity, due partly to rapid advances in electric lighting, but more perhaps to the prominence given to electrical affairs by the successful exhibition at Paris. The storage of electricity, so called, though not new, has been greatly developed and improved during the year. From being a laboratory experiment known to few it has risen to be a promising factor in the practical application of electricity to every-day affairs. The employment of frictional electricity in the separation of bran from flour has been brought prominently before the scientific and milling world during the year, and a successful mill using electric purifiers throughout has been established. The electric railway has been more extensively tested in the carrying of many thousands of passengers at the Paris Exhibition; and ground has been broken for a commercial electric railway in Ireland. The system of telephonic stations for civic purposes begun in Chicago has been much extended, adding materially to the efficiency of the police system. Among the undeveloped but very promising discoveries made public during the year in connection with electricity we must not forget the experimental researches which have produced the photophone, thermophone, and other applications of radiant energy in the transmission of speech. Much that is useful may come from them.

The researches of Pasteur among the lower forms of life, especially those associated with certain malignant diseases, have given results which are perhaps more pregnant of benefits to come to humanity than any other work of the century. If by cultivating the specific virus of our more malignant diseases the morbific elements may be deprived of their malignant character and yet remain capable, when inoculated, of making the organism as proof against the true disease as a real attack of it would, preventive medicine has entered upon a stage of infinite importance to mankind. So far the tests seem to justify the most hopeful anticipations.

Enough has been said to remind us of some of the more notable results and promises of the year. A multitude of perhaps equally important topics crowd upon us for recognition—progress in the industrial arts; Arctic research; comets; archæological discoveries in Egypt, Mexico, and elsewhere; the Atlanta cotton fair and its proofs of an undeveloped world of wealth in the South; the great works begun in Florida for the transformation of a vast swamp into an industrial State; and scores of other enterprises begun or completed at home and abroad. This is a period of great things, and no man can afford either to remain in ignorance of them, or to supinely let the opportunities they offer for self service and public service go by unimproved.

PATENTS AS INVESTMENTS.

It has been said that the introduction of useful inventions seems to hold by far the most excellent place among human actions. Unfortunately this, like many other truths, is not sufficient of itself to incite the inventive faculty. In these money-getting times mere sentiment succumbs to pecuniary gain, and, when the value of an invention is called into question, it is not its moral or beneficial effect upon the community that is considered, but rather the more practical one of its influence upon the pocket. Do patents pay? is a question often put and frequently answered in the negative, but erroneously so. For the amount of money invested, there are few properties that have paid more handsomely. Take the leading investments of the day; how many of them are gigantic failures? Of course all patents do not pay, neither do all investments in any description of property; but in these days of wild speculation, railroad bubbles, and bank failures, it may be very opportunely asked whether thirty-five dollars, or a little over two dollars a year, paid to the government for a seventeen years' exclusive right in and to

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some useful invention, is not a promising investment? It at least is not a very extravagant one.

We all know of patents that have paid their millions, but we do not all know of the many thousands upon thousands of patents which have realized for their owners amounts varying from five thousand to fifty thousand dollars and upward. Contrast these realizations and the paltry outlay required with other investments, and where is the property which yields as large a return? That many patents do not pay is not always the fault of the invention, but not unfrequently is due to the want of proper commercial management, or to the clumsy form in which the invention, perhaps a very meritorious one, has been ushered to the public. But even these patents ultimately sometimes prove valuable, on account of the principle involved or some one particular construction or combination they cover, so that holders of subsequent patents are compelled to pay tribute, and it is never safe to consider a patent worthless because it is dormant. Its day, after the lapse of years even, may come unexpectedly.

Again, inventors frequently are at fault in not following up their inventions by fortifying the original patent with subsequent ones covering improvements in matters of detail. Nor should repeated failure discourage an inventor; for, if only one patent out of every ten pays, it will many times more than compensate for the cost of the ten. Not merely scientific men and mechanics, but men of leisure, will do well, then, to consider whether a patent, if only as a speculation, is not a cheap investment, even if the weightier consideration of advancing the cause of science or adding to human comfort, by ever so small a step, be altogether discarded.

VIBRATION OF RAILWAY BRIDGES.

It is not at all improbable that the coming railway engineer will design bridges and superstructures and machinery with a view to obviating the injury done to these structures by vibration caused by rolling stock in motion. To build a bridge capable of sustaining heavy loads is the aim of the engineer. He may accomplish this to his entire satisfaction so far as a dead weight is concerned; a tremendous load causes but little deflection, and the bridge is pronounced perfect. In one sense this would be a correct verdict, and yet it would not contain all the elements of a perfect bridge. The bridge is calculated to support a load much greater than it will ever be called upon to sustain, and the ordinary load will not strain any of its members by reason of the factor of safety. But when there is an undue or excessive vibration, the fibers are disturbed and a gradual weakening of the material is the result. To prevent vibration and unequal deflection it is important that the supports be made as uniform as possible. By making one portion of the rail support, whether on bridges or grade, stronger than another, the deflection being unequal, causes a vertical oscillation of rolling stock which is not only destructive to the stock but also to the substructure. This destruction arises not only from disturbance of foundations, but by reason of the tendency of long-continued vibration to separate the particles which constitute the mass of the material. We take a piece of tin, lead foil, annealed wire, or some similar metal, and bend it, and there is no perceptible injury or tendency to break, but we repeat the bending process between our thumbs and fingers, and pretty soon the fibers part and there is a break. This is precisely the case with an iron girder or other member of a bridge. Thus constant vibration has a tendency to weaken and destroy these structures, and to this may be assigned the cause of many mysterious and disastrous bridge failures. This vibration also tends to weaken joints and rivets, and unless the structure is under constant and thorough inspection disaster may occur. How to prevent excessive vibration is the question; but probably to follow the plan of the deacon in his construction of his "wonderful one-hoss shay," to "make each part as strong as the rest," would be as effective as any.

A cat, in walking along a large beam in a wood frame building has not the slightest effect on the structure; but let the feline take a lively trot on the beam, and the whole building trembles. A horse, in walking across a bridge, causes no perceptible vibration, but a trot gives it a thorough shaking up; and this vibration continues for some time after the animal has left the bridge. This vibration is more destructive than an excessive load moving slowly. A locomotive, in crossing a bridge at a high rate of speed, shakes the structure by the counterbalances on the driving wheels, precisely as the cat or the horse shakes the barn or the bridge.

The remedy for this, then, would seem to be to run slow over bridges, but this is obviously impossible with our high velocities on lines where bridges are frequently met with. It only remains, then, to prepare the bridges in all the details of construction to resist vibration as far as possible.

The above has reference to vertical disturbances; but the lateral strain, caused by the natural sway from side to side, which is the result of uneven surfaces, and the space left for lateral play between the flanges and the rails, is equally damaging to bridges. There is more or less lateral oscillation of rolling stock that cannot be avoided. This causes a series of vibrations in that direction which has the same tendency to weaken the members as the vertical disturbance.

It is claimed by good authority that long continued vibration crystallizes metal, which of course renders it unfit for service, and bridges that have seen long service should be examined to ascertain the exact state of the metal. The frequent breaking of rails is, no doubt, owing in a great measure to vibration as the primary cause. Many rails break near the ends, especially when the splices are loose and the ties near the joint and under it are "low." The ends of the rails being depressed by the wheels, spring back to their normal position, and vibrate with a singing noise like a huge tuning fork. If this looseness of joints continues long, a break is sure to follow. Oscillation produces vibration, which, in turn, produces crystallization, cracks, and breakages.

In a bridge, if one member is more exposed to vibration than another, it will in time become weakened, and the whole structure may fail mysteriously. A proper arrangement of stays and braces will prevent vibration, and this is a subject worthy the attention of engineers.

NAVAL AND COAST DEFENSE.

The annual reports of our military and naval authorities have lately given special emphasis to the well known facts that, though our relations with the rest of the world are friendly, war is ever liable to arise, and a sudden war would find our coasts utterly defenseless and our navy inadequate for any service likely to be put upon it.

A complete revolution has been wrought in the material and methods of naval and coast defense during the past fifteen years; and as a nation we have done little or nothing to keep ourselves abreast of the military and naval progress of the world. Meantime, our prolific inventors have been steadily at work devising new means and appliances of which the nations of Europe have not been slow to avail themselves; so that we as individuals have put into the hands of possible enemies the means of doing us fatal harm. Unless we bestir ourselves as a nation and begin to guard our rich and vulnerable seaports by defenses at once adequate for present needs and susceptible of easy strengthening as new needs may arise, the neglect may cost us in a day, in property destroyed and ransom demanded by a dashing enemy, more than it would have cost to make every seaport on the coast practically impregnable. The Chief of Engineers, General Wright, states the case very compactly when he says in his report:

"For many years no appropriations whatever have been made for the construction of new works or for the modifications of the old works which were built before the introduction of modern ordnance and armored ships, and which latter, although there were none better in their day, are now most of them utterly unfit to cope with modern ships of war. The earthen batteries more recently built in the positions which are available for such batteries in our harbors are generally in effective condition, though by reason of the late increase in the power of ordnance some of them should be strengthened by thickening the parapets and coverings of magazines. The casemated works of which our seaport defenses are necessarily largely composed were built when wooden walls were the only protection of guns afloat. Now ships of war are clad in armor up to two feet in thickness, and the old smooth-bores have been replaced by rifled guns, the largest of which throw shot of nearly a ton weight, and which burn at each discharge nearly a quarter of a ton of powder. While other maritime nations are adding to their already powerful navies heavily armored ships of war, which are armed with 81 and 100 ton guns, and which cost, exclusive of armament, more than $2,500,000, they are building armored defenses for the protection of their own coasts. Great Britain has already 500 guns in position behind armored defenses. We have not one such gun, nor have we any armored defenses whatever."

Approving of the position taken by the Chief of Engineers the Secretary of War lays proper stress upon the fact that "modern wars come on suddenly, that serious international disputes occur between nations the relations of which are apparently the most unlikely to be other than friendly, and that a condition of readiness for defense and an attitude of belligerency are sometimes the best preventives of actual war. We know that the necessary new works and the proper modifications of our old works will require many years for their completion, and it seems simply a matter of common prudence that we commence without delay and under liberal appropriations to put our coasts in an efficient condition of defense."

As to the means of coast defense the opinion of General Wright that the most efficient, most enduring, and least expensive are fortifications and torpedoes, is unquestionably the true one. One gun properly mounted and handled on land is as efficient as several guns of equal power afloat, owing to the greater certainty of aim.

An armored fort on land can have its power of resistance increased unlimitedly and much more rapidly than increased power of penetration can be given to guns. Not so with floating forts: their buoyancy is limited and their security is gone the moment a gun is made of greater penetration than they were built to withstand. Several fixed forts (whether simply revolving, or both revolving and movable about a defensive mole) can be built for the price of one sea-going ironclad mounting as many guns of like caliber; and the fixed fort is not liable to be enticed away, as ironclads are, leaving a harbor defenseless.

Our geographical position and general policy forbid offensive war on our part, thus relieving us absolutely of the need of building the huge sea going fortifications of the sort favored by European powers. This fact is clearly though grudgingly recognized in the recent report of the Naval Advisory Board, convened last summer to consider plans for the reconstruction or rather recreation of our Navy. They say:

"Since it was decided that iron clads must be left out of consideration, it became necessary to determine upon auxiliary means of defense, which, although not so far-reaching in their protection, should still hold foreign armored fleets in check until armored defense could be provided."

Naturally professional spirit led the Board to contemplate only floating "armored defenses," the best service of which, as we have seen, may more cheaply and efficiently be rendered by armored defense on land.

The auxiliary means of defense recommended by the Board for immediate construction are:

Two first-rate steel, double-decked, unarmored cruisers, having a displacement of about 5,873 tons, an average sea speed of fifteen knots, and a battery of four eight-inch and twenty-one six-inch guns. Cost, $3,560,000.

Six first-rate steel, double decked, unarmored cruisers, having a displacement of about 4,560 tons, an average sea speed of fourteen knots, and a battery of four eight-inch and fifteen six-inch guns. Cost, $8,532,000.

Ten second-rate steel, single-decked, unarmored cruisers, having a displacement of about 3,043 tons, an average sea speed of thirteen knots, and a battery of twelve six-inch guns. Cost, $9,300,000.

Twenty fourth-rate wooden cruisers, having a displacement of about 793 tons, an average sea speed of ten knots, and a battery of one six-inch and two sixty-pounders. Cost, $4.360,000.

Five steel rams of about 2,000 tons displacement, and an average sea speed of thirteen knots. Cost, $2,500,000.

Five torpedo gunboats of about 450 tons displacement, a maximum sea speed of not less than thirteen knots, and one heavy powered rifled gun. Cost, $725,000.

Ten cruising torpedo boats, about one hundred feet long, and having a maximum speed of not less than twenty-one knots per hour. Cost, $38,000.

Ten harbor torpedo boats, about seventy feet long, and having a maximum speed of not less than seventeen knots per hour. Cost, $250,000.

With the exception of the cruising torpedo boats recommended, all of the proposed vessels would seem to be gravely inefficient with respect to sailing capacity. An unarmored cruiser carrying only light guns, if unable to overtake a first class merchant ship or run away from an armored vessel carrying heavier guns, would be of very little use in actual warfare. They might be comfortable for naval officers to cruise in in times of peace, for lying off popular summer resorts, or for picnicking along friendly foreign shores; but they would not do to rest national security and honor on in times of serious conflict. Instead of speeds of from ten to fifteen knots an hour, our unarmored cruisers should aim to be able to make, when occasion demanded, not less than eighteen knots, and from that to twenty-five knots. Both armored and unarmored war ships of thirteen knots and less have gone out of fashion the world over, and except in a war of grain ships and mackerel smacks, the proposed thirteen knot rams would be as useless as so many billy-goats.

Our cruisers should be built with special reference to staunchness and speed. With proper coast defenses we would not be likely to be involved in war with any nation likely to hurt us except in harrying our coast-wise commerce or the foreign merchant marine, which is to be developed, we trust, in the near future. Against such an attack the means of striking back in kind would be our best weapon. And the same fast cruisers, wind-wafted for the most part in time of peace, would be best adapted for the scientific, humane, and other peaceful occupations likely to engage them during most of their lives. Instead of idling at home or in foreign ports, we should like to see our navy always engaged in works of exploration scientific investigations at sea, or cruising up and down the great commercial routes for the protection and relief of mariners and travelers. They should hover upon the track of storms like Mother Carey chickens, in search of distressed or disabled merchantmen; and the practical schooling in seamanship, pluck, and energy, which our naval officers and men would thus gain in times of peace, would stand us in good stead during the trying times of war, should war ever prove honorably unavoidable.

Salt in Diphtheria.

In a paper read at the Medical Society of Victoria, Australia, Dr. Day stated that, having for many years regarded diphtheria, in its early stage, as a purely local affection, characterized by a marked tendency to take on putrefactive decomposition, he has trusted most to the free and constant application of antiseptics, and, when their employment has been adopted from the first, and been combined with judicious alimentation, he has seldom seen blood poisoning ensue. In consequence of the great power which salt possesses in preventing the putrefactive decomposition of meat and other organic matter, Dr. Day has often prescribed for diphtheritic patients living far away from medical aid the frequent use of a gargle composed of a tablespoonful or more of salt dissolved in a tumbler of water, giving children who cannot gargle a teaspoonful or two to drink occasionally. Adults to use the gargle as a prophylactic or preventive, three or four times a day.

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How Voltaire Cured the Decay of his Stomach.

In the "Memoirs of Count Segur," there is the following anecdote: "My mother, the Countess de Segur, being asked by Voltaire respecting her health, told him that the most painful feeling she had arose from the decay in her stomach and the difficulty of finding any kind of aliment that it could bear. Voltaire, by way of consolation, assured her that he was once for nearly a year in the same state, and believed to be incurable, but that, nevertheless, a very simple remedy had restored him. It consisted in taking no other nourishment than yolks of eggs beaten up with the flour of potatoes and water." Though this circumstance concerned so extraordinary a person as Voltaire, it is astonishing how little it is known and how rarely the remedy has been practiced. Its efficacy, however, in cases of debility, cannot be questioned, and the following is the mode of preparing this valuable article of food as recommended by Sir John Sinclair: Beat up an egg in a bowl, and then add six tablespoonfuls of cold water, mixing the whole well together; then add two tablespoonfuls of farina of potatoes; let it be mixed thoroughly with the liquid in the bowl; then pour in as much boiling water as will convert the whole thing into a jelly, and mix it well. It may be taken alone or with the addition of a little milk in case of stomachic debility or consumptive disorders.

PIG IRON BREAKER.

Among the exhibits at the American Institute Fair this fall, no machine attracted more attention than "Blake's pig iron breaker," exhibited by the Blake Crusher Company, of New Haven, Conn., the original patentees and manufacturers of the "Blake challenge rock breaker" of world-wide reputation. The pig iron breaker was designed and built in response to repeated solicitation from foundrymen and others for a machine to break pig iron into pieces, seven to eight inches in length, for foundry purposes.

Heretofore this has been done by hand, either by lifting the pig bodily and throwing it down on a V-shaped mass of iron or by striking with a sledge hammer. The work, especially in the case of the tougher varieties of iron, was necessarily severe, slow, and expensive. Repeated blows with a heavy sledge hammer wielded by a practiced hand would often fail to break a pig of iron. The pig iron breaker is strong and effective, and so simple that the illustrations of it which we present leave little to be desired in the way of explanation. The pig is fed in on an inclined or yielding trough, furnished with rolls, passed over a V-shaped knife to an adjustable stop on the end of the sliding head, A. This sliding head is provided with two knives, equidistant from the center knife on which the pig is supported, and has a motion of two inches.

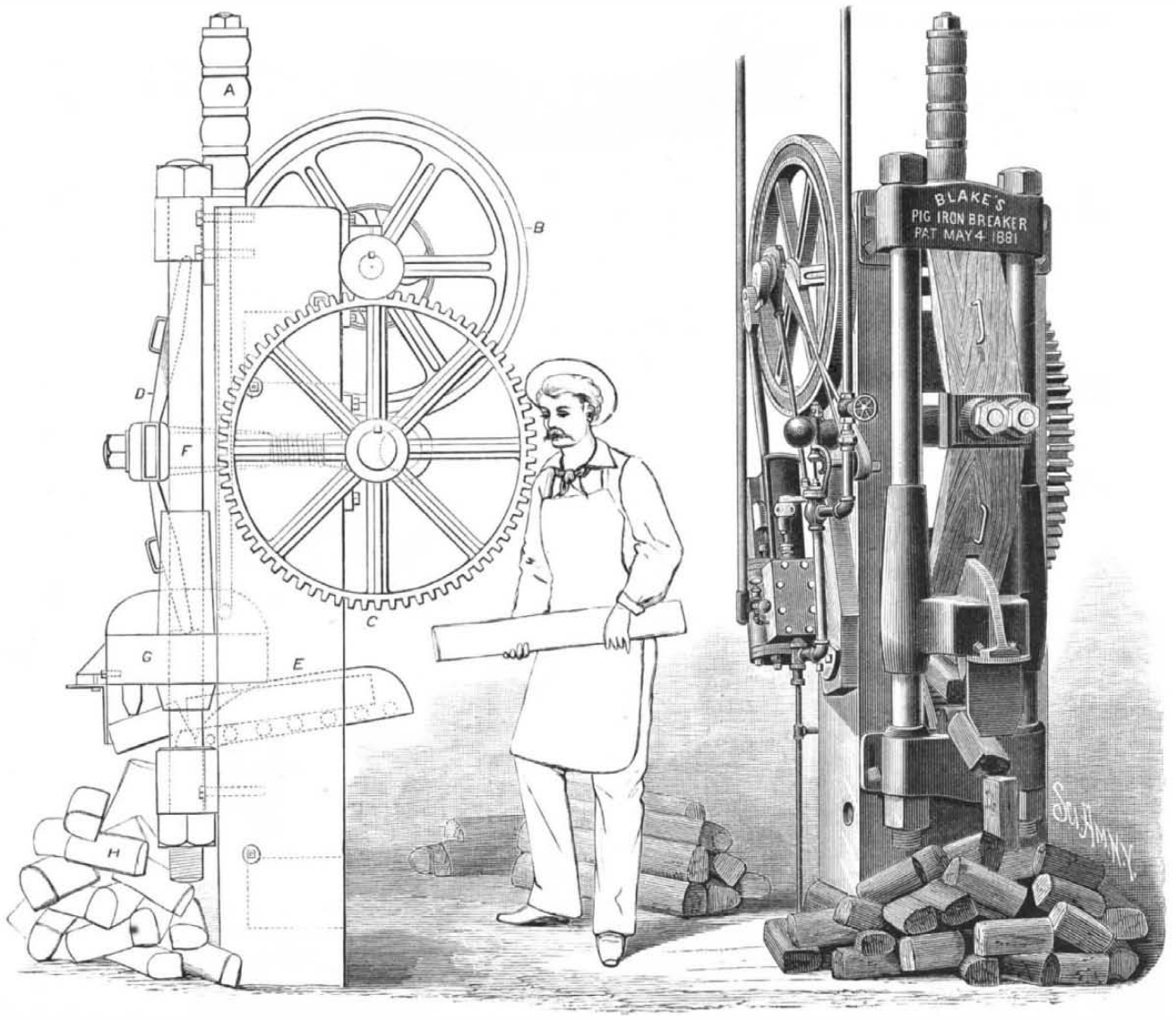
The sliding head descends, and a piece of the pig extending from the center bearing or knife to the "stop" is broken; it ascends, the pig is struck forward, and another piece is broken from the pig by its subsequent descent. In this way successive pieces are broken from the same pig with great rapidity and ease, with an expenditure of but from two to three horse power. In fact the product of the machine is limited only by the rapidity with which it is fed. Iron can be broken as rapidly as it can be discharged from the cart or car which brings it to the foundry yard.

The machine may be stationary and run by belt or by small engine bolted to the side of its timber frame, to which steam is conveyed by pipe from the boilers at the works where it is used, or it can be mounted on a car with engine and boiler and be moved on a track along the piles of iron to be broken.

The Blake Crusher Company is now mounting one in this way for the Albany and Rensselaer Iron and Steel Company, Troy, N. Y., where 500 tons are broken daily for making Bessemer steel. At present the pigs are broken by hand into but two pieces.

It is thought that the breaking of pigs into a greater number of pieces by machine will secure a more intimate admixture with the fuel and fluxes in the cupolas, greater economy not only in heating but in melting, and a greatly increased product of steel in the same number of hours.

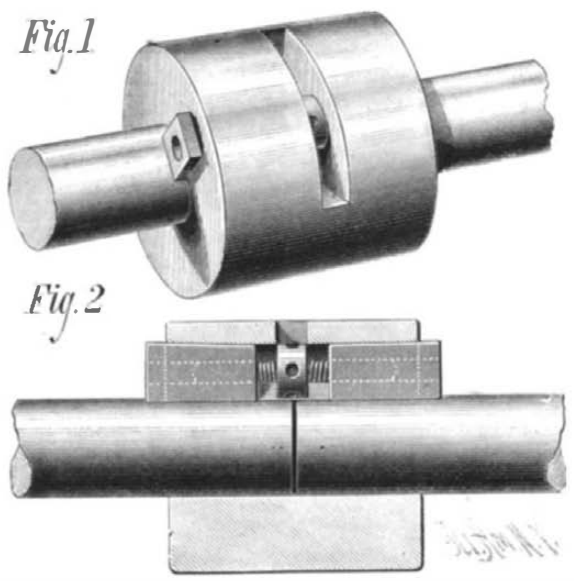
The machine is the invention of Theodore A. Blake, Mining Engineer and Secretary of the Blake Crusher Company, New Haven; was patented May 3, 1881, in the United States, also in England. It received the award of "medal of excellence" at the recent fair of the American Institute, where the Blake Crusher Company was awarded the semi-centennial gold medal for their challenge rock breaker.



BLAKE'S PIG IRON BREAKER.

IMPROVED SHAFT COUPLING.

We give an engraving of an improved shaft coupling lately patented by Messrs. J. B. Dyson & S. K. Paramore, of New Britain, Conn. It is very simple, easily constructed and easily applied, and when it becomes necessary to disconnect the shafts it is easily removed. The adjacent ends of two shafts are inserted in a sleeve which fits the shafts and has a longitudinal groove formed in its inner surface. This groove is tapered or inclined on the top from its ends toward its center, as shown in the sectional view, Fig. 2.



NOVEL SHAFT COUPLING.

Two keys, corresponding in shape to the groove, fit against the inclined bottom of the groove. The inner sides of the keys are concaved or flat to rest upon the sides of the two shafts. One key has a right screw hole and the other a left screw hole cut through it, into which fit the threads of the right and left screw, whose middle part has a collar formed upon it in which are formed a number of radial holes to receive the end of a pin to serve as a lever or handle for turning the screw.

When the screw is turned in one direction the keys are drawn inward toward each other, and clamp the ends of the shafts securely, and when the screw is turned in the other direction the keys are pushed outward, releasing the shafts. It will be noticed that the sleeve is slotted transversely opposite the collar of the screw to allow the lever or operating handle to be inserted in the holes in the collar and turn the screw. It is unnecessary to mention the advantages possessed by this coupling, as it can readily be seen that it is in every particular a practical thing.

The American Public Health Association.

The American Public Health Association, in session at Savannah, Georgia, December 1, elected the following officers: President, Professor R. C. Kedzie, of Michigan; First Vice-President, Dr. Ezra M. Hunt, of New Jersey; Second Vice-President, Dr. Albert L. Gehon, U.S.N.; Treasurer, Dr. J. Berrier Lindsley, of Tennessee; Executive Committee—Dr. James E. Reeves, West Virginia; Dr. Stephen Smith, New York; Dr. Thomas L. Neal, Ohio; Dr. J. G. Thomas, Georgia; Edward Fenner, Louisiana; and Dr. John H. Rauch, Illinois. The papers read at this meeting have covered, as usual, a wide range of topics relating to public sanitation. The meeting next year will be at Indianapolis.

The King of Siam to the United States.

General Halderman, our Consul General in Siam, has received from His Majesty the King of that far off country a promise to furnish a memorial stone for the Washington National Monument.

Another Great Ocean Steamer.—The Servia.

The new Cunard steamship Servia arrived at this port Dec. 7, after a stormy passage of thirteen days. For the first seven days she had to buffet severe head winds, at times approaching a hurricane. Her best day's run was on the 6th, when she made 406 miles. Her gross tonnage is 8,500 tons; engine power, 10,000 horse power.

The length of the Servia is 533 feet; breadth, 52 feet; depth, 44 feet 9 inches. Her cargo capacity is 6,500 tons, with 1,800 tons of coal, and 1,000 tons water ballast. She has a double bottom on the longitudinal bracket system. The anchor davits are 8 inches and the chain cable pipe 22 inches in diameter. The propeller shaft weighs 26½ tons, and the propeller, boss, and blades are 38 tons in weight. The machinery consists of three cylinder compound surface condensing engines, one cylinder being 72 inches and two 100 inches in diameter, with a stroke of piston of 6 feet 6 inches. Her boilers are seven in number, 6 of them double and 1 single ended, all made of steel. She has 39 corrugated furnaces. There are 168 state rooms, with accommodation for 450 first class and 600 steerage passengers, besides a crew of 200 officers and men. The ship is divided into nine watertight bulk heads, and carries twelve life-boats. In the engine and boiler spaces are water-tight doors which can be shut from the upper deck in case of accident in about two seconds. The keel of the ship has five thicknesses, making a total thickness of 6¾ inches. The riveting was done by Tweedell's hydraulic riveter, and all the frames and beams of the vessel were riveted by this process. The lower deck is of steel, with a covering of teak above the engine and boiler spaces, and the upper and main decks are both of steel with wood coverings. All the deck houses and deck fittings, the positions of which render them liable to be carried away during heavy weather, are riveted to the steel decks underneath.

The Servia is equipped with Muir & Caldwell's steam steering gear, steam winches, a steering gear independent of that managed by steam apparatus, and Sir William Thomson's compasses. Every separate passage in the vessel is ventilated by a series of ventilators. The cabins and saloons are heated by steam. The construction of the Servia was superintended by Captain Watson, of the Cunard service, and Mr. William Muir, the company's engineer at Glasgow. In every part of the ship the most advanced scientific improvements have been adopted. The very best material has been used.

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EXPERIMENTAL BOILER EXPLOSION.*

Mr. D. T. Lawson, of Wellsville, Ohio, as our readers know, has been conducting experiments with a view to determining the nature of the causes of the explosion of steam boilers, and as a result of these experiments he maintains that his original theory of boiler explosions is correct.

He believes that water raised to a high temperature, when confined and under pressure, will burst into steam when the pressure is removed from its surface; and if the exploding water meets resistance, as in a closed boiler, the effect of the concussion will be greater than the regular steam pressure.

For his experiment, Mr. Lawson had a plain cylinder boiler made in the best manner, of the best iron. It was six feet long and thirty inches in diameter. Its heads were of three-eighths inch flange iron secured by a one inch stay rod running from one head to the other. The shell was of three-sixteenths iron.

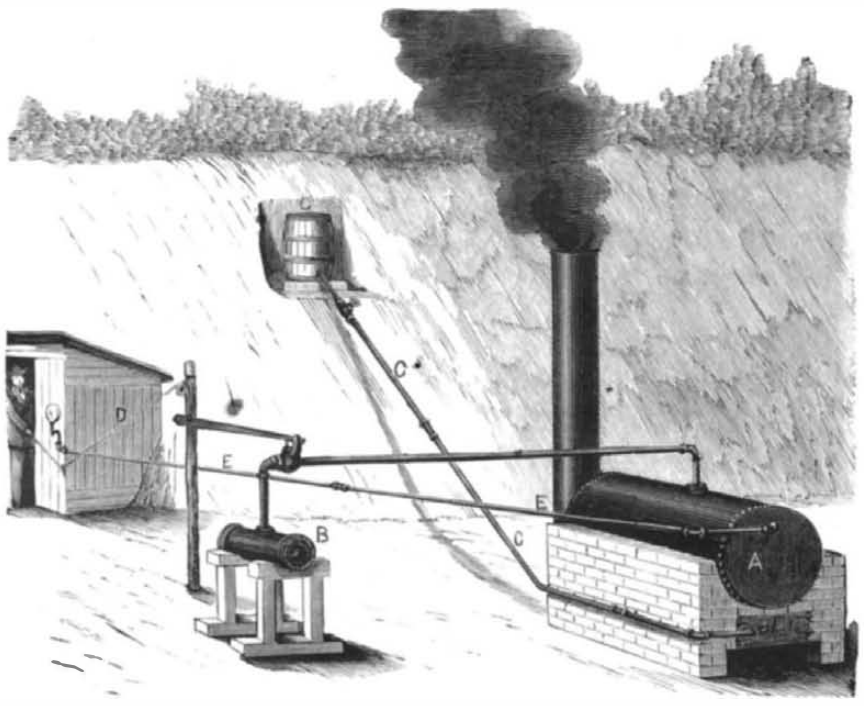
The boiler was set in an arch and connected by a pipe with a closed cylinder, into which steam was admitted to suddenly relieve the surface of the water in the boiler from pressure. A first class steam gauge was placed in the bomb-proof and connected with the boiler by a pipe about forty feet long. The valve, controlling the escape of steam from the boiler to the cylinder, was arranged to be operated by a cord from the bomb-proof. The boiler was filled with water eleven inches above the fire line, and the fire was supplied with extra fuel in the form of petroleum, the supply of which could be controlled from the bomb-proof. After a few preliminary experiments the final and successful one was tried on the 16th of June last.

Steam was raised to 260 lb., when the valve was opened, the index of the steam gauge fluctuated some 30 lb., showing an extraordinary disturbance in the boiler, and nothing more. A repetition of this with steam at 300 lb., at 335 lb., and at 365 lb., produced the same results. But when the valve was opened at a pressure of 389 lb., the boiler exploded with a loud report, scattering fragments of its shell, furnace, and stack in all directions. The stone foundations were driven several inches into the ground.

It is stated that there were evidences that the plates were rent at least four times transversely and torn open the entire length. One piece had a hole blown through it about the size of a man's hand.

It was estimated that the boiler would have borne a continuous pressure of over 700 lb. per square inch. There seems to be ample evidence that it required an extraordinary force to effect the destruction of the boiler.

We understand that Mr. Lawson has some further experiments in contemplation which he expects will furnish additional proof of the correctness of his position.



LAWSON'S EXPERIMENTAL BOILER EXPLOSION—ARRANGEMENT OF BOILER.

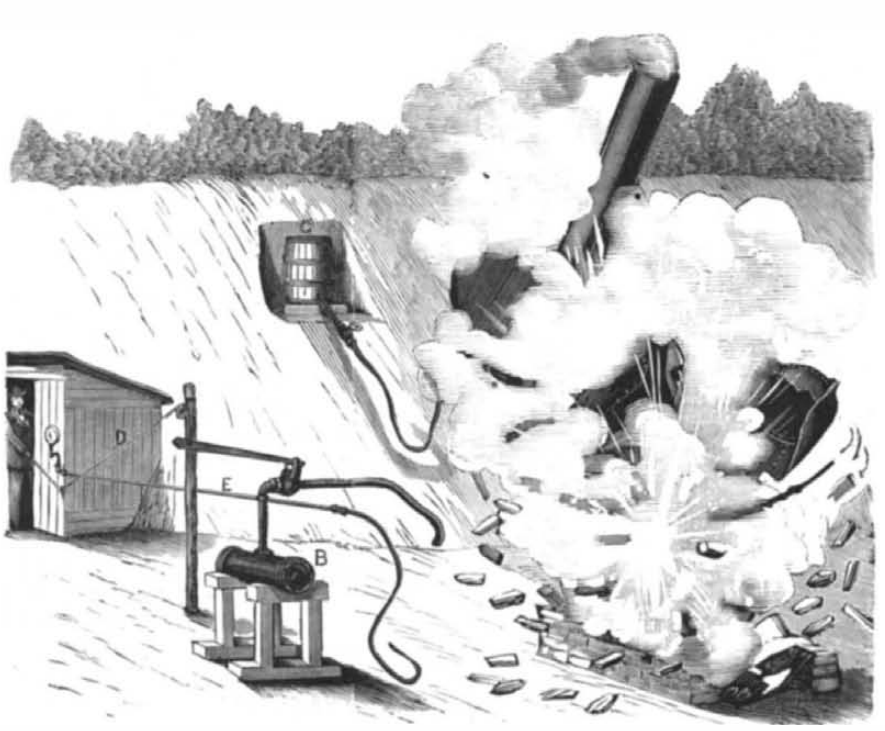
The Elias Magneto-Electrical Machine.

The magneto-electric machine of Signor Paccinotti, which forestalls the "Gramme ring" by several years, has been brought into fresh repute by the discourse of M. Govi delivered at the Electrical Congress, and by its exhibition in the Italian Section of the Exposition at the Palais de l'Industrie.

Close beside it, however, in the Dutch Section, is another old machine which has not received all the attention which it deserves. Indeed it does not appear to have been on view all the time the Exhibition has been practically complete. This apparatus was invented by Herr Elias as far back as 1842, and as it contains a somewhat similar ring to that of Gramme, it may be said to have anticipated Paccinotti to a certain extent. It consists essentially of two concentric rings of soft iron, each about one inch and a quarter broad and half an inch thick, and wound with gutta percha coated wire in six sections. The outer ring is the inducing electro-magnet, which is fixed, and the inner ring is the revolving armature, which is mounted on an axle which carries a slip commutator with contact rubbers of copper after the plan now so universally adopted in dynamo-electric machines. There are six knobs or teeth projecting inward from the outer iron ring and serving for magnetic poles, in front of which the armature coils revolve. The wire is wound continuously on the outer ring, but in the reverse direction in each of the six succeeding sections. This arrangement is designed to make the projecting poles alternately positive and negative. From opposite diameters of this ring a connecting wire runs to the commutator, and connects to three of its six slips alternately. The result is that as the inner armature revolves the alternating currents generated in its coils are led off by the wires connected to the copper rubbers as a continuous current; for the brush which draws a positive current from one slip also draws a positive current from the next, because the slips are alternately connected to coils on opposite sides of the ring, and passing in front of opposite poles of the electro-magnet.

The machine is exhibited by the Ecole Polytechnique of Delft, and is accompanied by a book on the apparatus, written by its inventor, and published at Haarlem in 1842.

Both its author and printer are now dead, and no other copy is known to be in existence. It contains a very good engraving of the machine as it stands, and we should have liked to reproduce this diagram, but the book is considered so rare and interesting that it has been taken away for purposes of translation.



LAWSON'S EXPERIMENTAL BOILER EXPLOSION.

Remarkable Lathes.

The London *Iron Trade Exchange* has printed a paper contributed to the Iron and Steel Institute by Colonel Maitland,

FRAGMENTS OF THE EXPLODED BOILER.

Superintendent of the Royal Gun Factory, at Woolwich, Eng., in which appears the following in relation to the gun turning lathes:

"The very nature of the manufactures in the Royal Gun Factory necessitates the turning of very large and very heavy masses. Lathes have therefore been designed and completed in this department remarkable for magnitude and power. They can deal with weights up to 200 tons, and are sufficiently powerful to reduce by six inches at a single cut the diameter of a 12-foot tube. These lathes have the following dimensions: 6-foot centers, 60-foot beds. There are nearly 200 tons of material employed on each of them, and the maximum power of their gearing is 150 to 1."

MECHANICAL INVENTIONS.

An improvement has been made in double oscillating engines, in which two vibrating pistons, attached to separate rock shafts in axial line with each other, are arranged within sector-shaped chambers, and carry crank arms on the outer ends of their rock shafts. Attached to these arms are rods which serve to reciprocate slides, that work in suitable slideways, and have pivoted to them rods which are connected with cranks on the driving shaft of the engine. This forms a very compact and efficient engine, and is the subject of a patent recently granted to Mr. Robert L. Stevens, of Albany, Oregon.

An improved stop motion for warping machines, which allows the winding of single or double threads, and will insure stoppage of the machine, has been patented by Mr. John B. Greenhalgh, of Blackstone, Mass. This invention is an improvement upon a former invention by the same party. The improved devices are fitted between the cylinder and bobbin stand of the machine. In operation the threads pass from the bobbins, through guides, to and through eyes of fallers, and through a vibrating guide to the beam on the cylinder. The fallers are thus held up out of reach of a rod that is constantly vibrated. A belt shifter is set to hold the operating belt to the fast pulley, and a latch-engaging lever retains the shifter. In case any thread breaks, its faller, being thus released, drops into the path of the vibrating rod, and the rod, by coming into contact with said faller, moves a bar to which the fallers are pivoted, and which projects upward from a shaft that, in thus being partially turned, releases the belt shifting mechanism, and causes the belt to be thrown on to the loose pulley.

Mr. Peter McCourt, of Grand Haven, Mich., has patented an improvement in loose pulleys, whereby the rattling noise usually common to such devices, and which is consequent upon the wearing of their bearings, is avoided. The invention consists in a pulley, which operates as a loose one, rigidly mounted on a shaft having a bearing in its hanger, and having its one end fitting loosely on a box that is loosely mounted on the end of the shaft on which the driving pulley is mounted, so that the loose pulley will not revolve loosely on its shaft, but the independent shaft of this pulley will rotate in its bearings. The loose box in which the adjacent ends of the two shafts have a bearing remains stationary.

A simple but serviceable improvement in harrows has been patented by Mr. John H. Stokesbary, of Aurora, Neb. This invention consists in making the tooth bars of the harrow square with the perforations for reception of the shanks of the teeth passing diagonally through them, and securing the harrow teeth by upper and lower notched or angular washers receiving opposite angular portions of the bars between them, said washers being secured on the teeth against the bars by nuts on the tooth shanks above the bars and shoulders on said shanks below the bars, and serving to strengthen the bars where they are weakened by the perforations for the teeth, and to prevent the said bars from being split by the side pressure of the teeth.

Mr. Kittil Anunsen, of Winchester, Wis., has patented an improved turbine water wheel. This invention consists of a vertical circular case containing a horizontally revolving water wheel having inclined buckets, and containing above said wheel a fixed circular platform having a circle of inclined tubes inserted through it near its periphery, which tubes extend downward to deliver water into the buckets; and it consists, further, of a movable circular disk or cut-off covering the face of the tube platform, and having a circle of inclined apertures corresponding with the tubes, which cut-off is capable of being turned about its vertical axis, by any suitable mechanism, for the purpose of closing the tubes or of bringing the apertures in coincidence with them. Means are also provided for clamping the cut-off disk down upon the tube platform and holding it immovable thereon in any desired position, and for releasing it when it is necessary to adjust the cut-off. This makes a cheap and effective water wheel.

A very useful attachment to printing telegraph instruments, in the shape of a tape supporter, has been patented by Mr. Edward J. McLoughlin, of New York city. The object of this invention is to provide a device especially applicable to stock printing telegraph instruments for supporting and displaying the tape as it runs from the instrument and thereby preventing its disarrangement. The device consists of a shallow trough within and along which the tape passes as it is run from a stock or other printing telegraph instrument. This trough is constructed at its one end to admit of its ready attachment by a thumbscrew to the edge of the table on which the instrument sits, and is provided at or near its outer end with a transverse rod arranged to prevent the

* In SUPPLEMENT 313 will be found an essay by Mr. Lawson in which he gives a detailed account of this experiment, and sets forth the principles he claims to have discovered.

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tape, as it is handled, from being disengaged from the trough.

A valuable improvement in ore roasting and chloridizing furnaces, especially designed for working gold and silver ore, has been patented by Mr. Robert A. Nevin, of Silver Cliff, Col. The ore to be operated on is first fed into the higher end of an inclined revolving cylinder or furnace, and passing through said furnace is exposed to a gradually increasing temperature as it approaches the fire box of the furnace, whereby said ore is partly or wholly desulphurized. From the lower end of this furnace the desulphurized ore falls, through an inclined passage or chute in the flue which leads to the chimney, into the higher end of a second inclined revolving cylinder or furnace, and as said ore passes through said chute, chloride of sodium is introduced to mix with it and to fall with it into the second cylinder, down through which the mingled ore and salt pass, subject to a gradually increasing temperature, whereby the metallic portions of the ore are chloridized, and the ore is ready for subsequent lixiviation or amalgamation. By desulphurizing the ore before the application of the salt, the metallic portions of the ore and the chlorine of the salt more readily and thoroughly combine, thereby effecting a saving of the salt and of the metals, and, by the passage of the ore from one furnace into the other being continuous, the ore does not become cooled in the operation.

A simple but apparently practicable and effective method of holding underground telegraph wires separate from each other, and properly insulating and protecting them, has been patented by Mr. John B. Morgan, of Kansas City, Mo. In this improvement a succession of metallic boxes, preferably of rectangular form and open at both ends, are arranged in trenches at the requisite depth beneath the surface of the ground. These boxes are formed with outwardly extending flanges along their upper edges and at their ends, which flanges are longitudinally grooved for holding the leaden gaskets or seals with which covers are sealed or jointed to said boxes and with which the boxes themselves are jointed to each other. The covers are scarfed at their ends to form overlapping joints with each other, and are provided with gates for pouring in the molten lead to seal them. Before placing on the covers, however, the boxes are filled with a series of longitudinally grooved boards mounted one upon the other, and having the telegraph wires arranged within their grooves, each board as it is put in place, commencing with the lowermost one, and the wires contained in its grooves, being smeared by a brush with melted paraffine or wax. This thoroughly insulates the wires and acts as a seal between the surfaces of the boards.

Messrs. John E. Chamberlain and George W. Kemp, of Charleston, W. Va., have patented certain improvements in rope railways. This invention relates to inclined rope railways, in which coal, earth, or other material is conveyed from an elevated to a lower point in cars or baskets suspended from a pair of wire cables stretched between the receiving and discharging points at proper tension, the descending loaded car or basket on one cable causing the ascent to the loading point of the empty car on the other adjacent cable. In rope railways of this class, as previously constructed, no means were provided for preventing the bellying or sagging from the main wire cables of the check ropes connecting the suspended cars and the winding drum, which sagging would quite overcome the gravity of the descending loaded car when at a point opposite the ascending car on the adjacent cable and bring both cars to a stop, and consequently compel the use of power other than the gravity of the loaded car to lower the latter to the discharging point. This invention consists in a method of preventing the sagging of the check ropes and thereby dispensing with an auxiliary power, by supporting the check ropes on independent clevises on the main cable. These clevises are flexibly connected, whereby they will spread apart to support the check ropes as fast as the latter unwind. A chain connection is preferred for this purpose. Both of the inclined main cables of the railway are similarly provided with these traveling clevises. The invention also consists in a combination with the car having a hinged bottom, supported by a sliding locking bar and catch, of a bumper at the lower end of either inclined cable, for the bar to strike and release the car bottom and whereby the contents of the car are automatically dumped. These are valuable improvements.

Mr. Charles W. Dean, of Taunton, Mass., has patented an improved cut-nail machine. This machine is more especially designed for making hooked nails, but is also adapted for making nails of various other shapes. When in operation the nail plate is fed by hand or otherwise over a bed knife. A cutting jaw then rocks downward, and with its knife cuts a nail blank, which is instantly griped between the end of a moving die and a stationary bed die, and is held until it is headed by a movable header. The cutting jaw is provided with an offset carrying a horn, and the heading lever has also a horn. These two horns are connected by a pin which is supported at its ends in socket boxes, of which the one in the cutting jaw horn is adjustable in an elongated slot, to change the throw of the heading lever. As the cutting jaw rocks upward the heading lever is drawn inward until the point of the header is opposite the nail to be headed, when the horn of the cutting jaw tilts upward also, and by means of the connecting pin rocks the heading lever sidewise so as to bring the point of the header to bear with pressure upon the nail end. The operating mechanism is simple and not liable to get out of order, and every necessary provision is made for removing and replacing the principal working devices, also for changing certain parts to make nails of various kinds.

PROPOSED NEW SYSTEM OF WATERWORKS FOR CHICAGO.

[*Continued from first page.*]

a combination consisting of a greater number of smaller pumps, each arranged to follow at equal distance. It is everywhere conceded that to obtain the best result from fuel, an expansion of steam varying from four to six times must be practiced.

"Where, as in the case of moving water, the load or resistance is constant, expansion of steam upon a direct acting piston is not practicable. Where the load is elastic and the character of the work to be performed is such as will admit of varying periphery speed, the theoretical economy of expanding steam will be partially realized in practice.

"The speed of pumping machinery should be comparatively slow, and the design should be selected with a view to maintain a uniform flow through the receiving and discharging mains. Many efforts have been made to utilize the principle of expansion of steam in pumping machinery, but so far without success.

"The beam pump, with steam and water cylinder at either end, and with intermediate crank shaft and prodigious flywheel, was expected to meet all demands; but in this design the fact that, to reproduce in useful work the extra pressure given to the piston in the commencement of the stroke, *an acceleration of speed must be given to the flywheel*, was overlooked, and it has been found advisable to disengage the expansion gear on this type of pumping engine.

"The compound or double cylinder expansion is the latest effort, yet as the terminal pressure must be equal to the load, and not being provided with reciprocating rotary motion, it is difficult, in fact impossible, to discover any advantage in this complicated combination. By expansion of steam, is meant that when the boiler pressure has followed the piston, say, one-fourth the length of the cylinder, communication with the boiler is cut off and the piston is impelled by the expansion or diminishing pressure, which, providing the boiler pressure be 100 pounds, will give a terminal pressure of 25 and an average 59 pounds. If the load is greater than the terminal pressure is capable of overcoming, the machine will stop. If there be rotary motion, but insufficiently charged by acceleration, it will also stop. If there be rotary motion of sufficient weight and sufficiently charged by acceleration to compensate for the diminishing pressure on the piston, the economy of expansion will be overbalanced by the power expended in acquiring acceleration.

"When the driving engine is permitted to make a greater number of strokes per minute than is being made by the pumps, the varying periphery velocity of the engine occasioned by the varying pressure on piston when working under a high rate of expansion will be inappreciable on the pumps, thus practically permitting a realization of the economy of steam expansion."

Mr. Golding's tender to the Commissioner of Public Works provided for ten single acting plunger pumps 30 inches diameter and 4 feet stroke. The pumps will be driven by spur wheel and pinion from a continuous shaft. The pinion will be permanent on the driving shaft, while the spur wheel will revolve loose upon the pump shaft and so arranged that the pump may be started and stopped at the will of the operator. The pumps will be placed in a continuous line and connected to the pinion on driving shaft in a division of ten. The pinion shaft will be connected by coupling at either end to two duplicate engines, only one of which need be connected, yet the connections will be such that either or both may be made to operate at the same time. The pump connections will be so arranged as to receive water from a receiving main which will be arranged to pass in line with the pumps, and the discharge will be arranged in like manner. The pinion will be geared one to four with the pump so as to allow the driving engine to make four revolutions while the pump shaft makes one. This combination will be capable of supplying fifteen million gallons in twenty-four hours with seven and a half strokes per minute of pumps and thirty revolutions of driving engine.

With the pumps making fifteen strokes per minute, and the two driving engines connected and making sixty revolutions per minute, will supply thirty million gallons in twenty-four hours continuously, and will do the same with one engine by allowing the steam to follow sufficient.

The engines will be furnished with adjustable cut-off or expansion motion. Steam will be supplied by three batteries of boilers, consisting of three double flue boilers, 26 feet long and 42 inches diameter, to each battery, and furnished with the usual approved connections. Each battery will be furnished with an independent feed pump of the beam and balance wheel type. The material and workmanship of the boilers will be of the best, the mountings and appurtenances will be the same as is usual and proper in such combinations. The steam and water connections will be arranged with a view of concentrating the steam upon either engine and of conveying the feed water from either feed pump to either battery of boilers.

The pumps are to be of the most primitive and simple design, consisting of a bucket plunger and a hollow base containing ordinary suction and discharge valves. The plunger has a cross head projecting through guides attached to the top of the pump, and having at each end a connecting rod carried by a crank on the shaft below.

In our engraving the larger view shows the complete system. Fig. 2 is a vertical transverse section of one of the pumps; Fig. 3 is a plan view; and Fig. 4 is a vertical section in the direction of the shaft.

The cranks of the several pumps are arranged relative to each other, so that they occupy different positions in the circle. This arrangement renders the flow of water continuous, and brings a practically constant load on the engine, enabling power to be applied to pumping as advantageously as to steam propulsion or manufacturing.

The material, workmanship, appurtenances, and general arrangement of the boilers will be made to conform to the United States Government inspection. The workmanship and material of engines, shafting bearings, and pumps will be in every particular first-class.

DECISIONS RELATING TO PATENTS.

United States Circuit Court—Southern District of New York.

LORILLARD & CO. *vs.* DOHAN, CARROLL & CO.—TOBACCO PLUG PATENT.

Reissued Letters Patent No. 7,362, dated October 24, 1876, granted to Charles Siedler upon the surrender of original Letters Patent No. 158,604, dated January 12, 1875, for an improvement in plug tobacco.

Wheeler, J.:

The decisions in *Lorillard vs. McDowell* (11 O. G., 640) and *Lorillard vs. Ridgeway* (16 O. G., 123) upon the question of the identity of the reissue with the original affirmed.

The force of English letters patent as references are overcome by evidence showing that the domestic patentee made the invention before the date of the filing of the foreign specification.

The use of screws, nails, coins, and other similar things pressed into the surface of the plugs at certain stages of the manufacture to identify some particular plugs to the manufacturers themselves, and not to go out into the market with the plugs, does not anticipate a mode of marking and identifying each separate plug of tobacco as being of a particular quality, origin, or manufacture, by tin labels or tags, having a desired inscription upon them, and prongs extending backward from their edges, pressed into the plugs in the last porcesses of manufacture, with their faces even with the surface of the plugs, where they would be held by the prongs and the surrounding tobacco.

Decree for injunction granted.

United States Circuit Court.—Southern District of Ohio.

WATKINS *vs.* CITY OF CINCINNATI.—LAMP BURNER PATENT.

Matthews, Cir. J.:

Reissued Letters Patent No. 7,706, being a reissue of patent granted Louis Fischer, March 30, 1869, for improvement in vapor burners, *Held* valid and infringed by burners known as "Globe burner" and "Champion burner."

The Fischer patent held to cover vapor burners having a tube or passage arranged to conduct a portion of the oxygenized vapor from the mixing or gas chamber to a point below where the commixture takes place, in order to heat the fluid in the lower part of the chamber.

Various prior patents distinguished from the Fischer and held not to embody the invention described and claimed in it.

United States Circuit Court—District of Connecticut.

FITCH *et al. vs.* BRAGG & CO.—SNAP HOOK PATENT.

This is a bill in equity founded upon the alleged infringement by the defendants of Letters Patent granted May 16, 1865, to Charles B. Bristol and others, assignees of said Bristol, for an improved snap hook. The patent is owned by the plaintiffs.

Shipman, J.:

When the claims of a patent are susceptible of various meanings, that construction will be adopted which, in view of the state of the art, limits the patentee to and gives him the full benefit of the invention he has made.

The general terms and sometimes special words in the claims must receive such a construction as may enlarge or contract the scope of the claim, so as to uphold that invention, and only that invention, which the patentee has actually made and described, when such construction is not absolutely inconsistent with the language of the claim. (*Estabrook vs. Dunbar*, 10 O. G., 909.)

When there is a new and beneficial result attained by a new arrangement of the parts of a combination, there is a new combination, although the action of certain elements may remain unchanged.

When in a snap hook the claim was for a combination of spring and recessed tongue, the recess being so located that by reason of the new location of the spring the hook was made cheaper and easier to clean, *Held* that it was immaterial whether the action of the spring had been improved or not, provided that there is a benefit which is the result of the new combination.

Effects of Pilocarpin on the Color of the Hair.

Dr. D. W. Prentiss, of Washington, D. C., gives an account of a remarkable change in the color of the hair from light blonde to black, in a patient while under treatment by pilocarpin, the case being one of pyelo-nephritis; the other being a report of a case of membranous croup, treated by pilocarpin, in which there was also a slight change in the color of the hair.

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STEAM BOILER NOTES.

On the 22d of November, the boiler at D. Milliken & Son's tannery, in Bangor, Me., exploded, demolishing the building, in which were seven men. William Barston was blown twenty feet through a window. His left arm and a portion of his left side were badly scalded, his right arm and thumb somewhat injured, and he was also scalded on the right side of his face. Albert Milliken was blown through the roof, but received only slight injury. A man named Ames was knocked down, but was uninjured. The physician says Barston will recover in a few weeks. The boiler was located in a pit below the level of the floor, and when the explosion occurred it was lifted up, went through the side of the building, and landed some distance from the tannery. The roof of the building fell in.

It is reported by a contemporaneous newspaper, technical as to cotton manufacturing in the East, that this "was of the Sullivan pattern" of boiler. Now there are divers "patterns" of boilers bearing this name in New England, and the announcement seems to mean nothing in explanation of the explosion; while users of the later and safer forms of Sullivan origin, which are now said to be accepted for insurance against explosion, may feel undue anxiety for their safety, and the numerous family of boiler-making Sullivans will naturally feel scandalized at the insinuation. It is, moreover, reported that this sample was not only a Sullivan, but it was understood to be a second-hand one.

It may be said, if it was of the same particular "pattern" as its namesake that blew a machine shop to atoms in Ellsworth, Me., in the summer of 1875, on the seventh day of its existence as an active steam boiler, then its having endured the test of practical use long enough to acquire the title of second-hand would indicate that it was a better individual than some of its relatives, a number of whom have gone up in a cloud of dust in early life.

At 10:10 A.M., September 28, an explosion occurred at the works of the Saginaw Barrel Company in Saginaw City, Mich. The explosion occurred in the room used for steaming logs preparatory to cutting them into hoops. The usual method of doing this work was by boiling the logs in large tanks, but in cold weather this was not considered the best way, and other means were resorted to. Charles H. Utter, Alex. Bush, Ira Nichols, and Frank Busshard were seriously injured. Utter was alive at last accounts, but his injuries are fatal. Nichols will likely recover.

The device that was to be substituted for the original was a boiler or shell, forty inches in diameter and about seven feet long. This was furnished with a cast iron head fastened on by bolts to the boiler. On the 26th steam was turned in the shell for the first time, and the scheme seemed to work satisfactorily. On the 28th, however, when the practical test was to be made, the result was far different. The log was put in, the head screwed on, and the steam turned in, when in an instant the whole front, weighing 600 pounds, was blown into fragments.

Mirabile dictu!—wonderful to be told!—and yet this often happens when seam joints are made by bolting together parts whose gasket surfaces do not coincide in form when brought together, touching at two or three points only. A cast iron disk or plate, being one of the parts, may readily be put in a state of tension in making a steam-tight joint, using long wrenches, lengthened perhaps by slipping over the wrench handle an old two-inch pipe, or attaching a block and fall to the eye in the end of the wrench handle, so that only just what was done here at Saginaw would be required to break the head into fragments, though it weighed even more than 600 pounds and was a sound casting at that, till it was overloaded. Or may be the gasket is bad, having thick and thin places or hard and soft places, and continuing to leak, Mr. Steamfitter continues to screw with his compound "purchase" till the bolts are just ready to "part" on the application of the full calculated load of steam pressure, and the thing blows off, to the great astonishment and serious injury of bystanders, who perhaps think it should be strong in proportion to the power applied to the wrench.

Of course it is impossible from this standpoint to say that anything of the kind took place at Saginaw, and the operators there may feel touchy about this hypothesis, but such things have happened in more refined establishments than barrel factories. It is more than probable that construction was faulty or the management bad. It is not at all probable that low water and overheated plates caused a sudden and violent evolution of an irresistible pressure, since no fire was present. It is not impossible, however, that the dynamite advocates may gather comfort for themselves from the possible fact that some malicious person could have concealed a cartridge in or upon the logs that were put in to be steamed.

The boiler in the Yazoo Oil Works, at Yazoo City, Mississippi, burst December 1, demolishing the boiler house and one end of the main building, and injuring seven men, four of them fatally.

John Steinheim was fatally injured by a boiler explosion in the Wadsworth Coal Company's mine near Doylestown, Wayne County, Ohio, at midnight, December 2. Another man was seriously hurt. The wounded men crawled half a mile to get to the surface of the mine.

It appears from the *Ironmonger* that a meeting of a committee of the Smoke Abatement Exhibition was lately held in London, England, where the announcement was made that the Society of Arts had resolved to add to its other prizes a special medal to be given in the name of the society to the inventor of the best smoke-consuming stoves and grates. Professor Chandler Roberts reported that he had arranged for chemically testing the products of combustion during the trials of the competing exhibits. The object, no doubt, is to ascertain whether or not combustible gas still remains after the elimination of the black color of the smoke.

An ordinance, which was lately approved by the Cincinnati Mayor and Board of Public Works, and which went into effect on its passage, provides for the appointment of an inspector of furnaces. It requires all users of steam boilers and other furnaces to provide some satisfactory method of preventing the discharge of black smoke into the atmosphere.

No doubt the general adoption of an effective apparatus for the actual consumption of the carbon that gives the dark color to the smoke of soft coal and other bituminous fuels would prove a great public benefit by the abatement of the smoke nuisance, and it would also effect a vast saving of fuel in almost every industrial establishment, whether the fuel yields black smoke or otherwise. A change of color, or its absence altogether, does not necessarily indicate that the escaping gases do not still contain combustible elements that should have been burned in the furnace or combustion chamber.

Anthracite furnaces improperly constructed or badly managed have been shown to be quite as wasteful as those that send out dense black smoke from bituminous fuel. In crowded manufacturing cities the peculiar odor of carbonic oxide, etc., a combustible compound from anthracite fires, is often perceived by occupants of dwellings or rooms on a higher plane than the chimney tops from which it escapes; and e in lower places, when the atmosphere is still and the barometer low, it is diffused in such quantity that its odor is perceptible. It may not be more injurious to health than the inodorous gases from more perfect combustion of anthracite, still it is possible that the double object of better air and a saving of fuel may be attained by perfecting the combustion of anthracite as well as bituminous coals.

At the last monthly meeting of the management of the Boiler Insurance and Steam Power Company (Limited), held in Manchester, England, the chief engineer reported that during October, 1881, 5,414 boilers had been inspected, of which number 58 were internally and 896 thoroughly examined; 25 boilers were also tested by hydraulic pressure. The principal defects found in the boilers were as follows: Corrosion of plates and angle irons, 212; fracture of plates and angle irons, 44; safety valves out of order or overloaded, 132; pressure gauges out of order, 67; water gauges out of order, 23; boilers damaged by overheating in consequence of deposit, 3; boilers damaged by overheating in consequence of deficiency of water, 8.

The item of special interest in this report is that relating to safety valves. In a single month it seems that 132 of these attachments were found to be no longer reliable as safety valves. This company has usually claimed entire immunity from destructive and fatal explosions of boilers in its care; and the expression used in this report, together with the large number "out of order or overloaded," without a single dangerous one being noticed, indicates the scrupulous care with which they watch and report this least departure from perfect order in this all-important appendage. It is probable that its inspectors are quite as critical in their observation and treatment of the progress of all kinds of deterioration to which steam boilers are liable, using the "ounce of prevention" in time to prevent the necessity of the "pound of cure." However this may be in its practice, it is here and now recommended as the only way to secure what this company has so often claimed in its reports.

A boiler in James Henry's shingle mill, Grand Rapids, Mich., exploded, November 27, killing Joseph Slater, the engineer, and David Hardy, of Maple Hill. George Bland was slightly hurt. The mill was entirely destroyed, and a dwelling adjoining the mill badly injured.

A boiler explosion occurred at Douglass & Son's mill, at Mud Creek, Texas, November 29, killing four men. The mill was blown to atoms.

Are Bees a Nuisance?

An unusual case is being tried in the Cumberland County (Penn.) Court this week, that of testing by a jury whether the keeping of a large number of bees in a town or borough is a public nuisance or not. The case is from West Fairview, a small town on the opposite side of the river from Harrisburg. Two citizens had about 130 skeps of bees, and as the summer was scarce of material such as the bees feed upon they came in large numbers into the houses, stores, grape arbors, and wherever there was anything for them to feed upon. In one instance they swarmed in a neighbor's kitchen, and were there for days, he not being able to hive them, the queen being killed. They were especially bad about canning and preserving time, compelling the housewife to do her preserving in the evening, and in one instance the wife had to climb in and out of the window for days, not daring to open the doors, for the bees would go in by hundreds; persons were stung passing along the streets and highways; entire houses became infested with bees, so much so that the inmates could not retire to rest at night without being stung by the bees; trays of fruit put out for drying were entirely consumed. Indeed, a reign of terror was experienced for several months, until a committee of citizens agreed to abate the nuisance, and, after several efforts, appealed to the court.

The defense claimed that the raising and keeping of bees was an industry, and as such could not come under the head of a public nuisance, and that suit could not be brought nor damages recovered for the keeping of honey-bees. The attorneys on both sides presented the opinions of several judges and the law points in the case, after which the court decided the case should be tried, and the testimony was received. But one case seems to be on record in the State, and that was tried before Judge Pearson, in Dauphin County, years ago, in which the defendant was adjudged guilty, and had to pay a fine and abate the nuisance.—*Harrisburg Telegraph.*

Correspondence.

Durability of Redwood.

To the Editor of the Scientific American:

Having been a subscriber for the SUPPLEMENT of your paper ever since the first number, and of the paper itself for many years, I do not wish it to be astray on any subject, as I look upon it as a sort of oracle for mechanics of all branches. But somehow or other an erroneous article from a local paper, here called the *Scientific and Mining Press*, in relation to the durability of redwood, has found its way into the columns of your paper.

Redwood, when exposed to alternations of wetting and drying, will not last more than three to five years before it is completely rotted. I am a bricklayer by trade, and have had about seventeen years' experience in this city of redwood houses, and I am certain of what I say. As regards putting redwood under brick walls, it is never done nowadays, and, in fact, never was done in any important structure. Where plank foundations are used here is on made land, in the region of the city front, and then they use plank of what is called Oregon pine, three inches thick; and this planking is supposed to be placed deep enough to be covered at all times with water, so as to exclude the air. Done in this way, I have seen some planks that had been down twenty-five years, and they were perfectly sound. Redwood placed deep enough in water to exclude air will also last for I do not know how long.

Within the last few years a great many houses that had been built of redwood, with 4 x 4 inch redwood posts, resting on a 3 inch plank of redwood for a foundation, have had to be placed on screws and a brick foundation put under them. The wooden houses here are numerous, so there is every chance to see how long redwood will last. I have seen the redwood stringers and sleepers of the street railroads taken up completely rotted after five years.

The particular kind of redwood that some call "black heart" is a humbug. As regards the sinking of redwood, I have often seen that, but they were pieces commonly called waterlogged. Messrs. Fulda Brothers are makers of wine casks, and not builders.

The way the name black heart redwood originated, at least the first mention of it I ever saw, was when the redwood pavements of this city came into disrepute from rotting away so fast. Some contractors said they would not do so if it was the black heart redwood; but the supervisors of the city were not humbugged that time, as they were a week ago, when a man calling himself an engineer, stated in his testimony before them that crude petroleum was not inflammable. Enough further information in regard to redwood can easily be had from any mechanic in the building trade in this city.

San Francisco, November, 1881. M.

Breaking of Steamer Shafts.

To the Editor of the Scientific American:

In case of an ocean steamer breaking her propeller shaft in a gale of wind, by no means such a rare occurrence, she must do one of two things: "Lay to" under canvas, or become unmanageable in the trough of the sea. The former course, where the modern ocean steamer is concerned, is an impossibility, and I wish to offer the following suggestion to prevent the latter.

Why not fit, and be kept ready for use in heavy weather, hydraulic pumps on each quarter, at whatever depth below the water line that proved convenient, the nozzles for which could be protruded from inboard whenever required to be used? Exactly similar to the hydraulic propulsion power fitted to H. B. M. S. Waterwitch. The Waterwitch, as a test, was tried in all weathers, and by means of this method obtained a speed of 9½ knots per hour. It was also used by her as an extra and very efficient steering power. In case of the shaft breaking the steamer's engines would be used for pumping and forcing the jet of water outboard on each side, instead of for turning a propeller shaft.

B.

Gas Treatment of Whooping Cough.

In the treatment of whooping cough in gas works, as lately resorted to, especially in London, the purifying chamber consists of a large room with doors and windows freely open, and each contains twenty-four vessels, holding five cubic meters of depurating substance—lime and sulphate of iron mixed with sawdust—through which the gas has to pass. When the workmen are emptying and refilling these vessels, the children with whooping cough are placed around it, and inhale the vapors which escape; they are in an atmosphere containing ammonium sulphide, carbolic acid, and tarry products. As to the efficiency of this treatment, one physician reports that of 120 cases persevered with, in twenty there was entire failure, forty-eight showed improvement, and the rest were cures; it is thought, however, that it acts only upon one element of the malady, viz., catarrh.

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NEW WORM AND WORM WHEEL AND GEAR CUTTER.

We give an engraving of an improved machine for cutting that class of worm wheels and endless screws in which the points of the teeth and the bottom of the spaces are formed on a concave outline adapted to the convexity of the screw, in order to present as much bearing surface as possible to its action. The teeth of the wheel in an endless screw are not, as in ordinary gearing, set perpendicularly to the plane of its face, but at an angle and with surfaces corresponding to the inclination and helical form of the thread of the screw. The outlines of the teeth are helical surfaces described about the cylinder, forming the screw with the proper pitch.

The old method of cutting the teeth in the wheel has been to first rough them out with a straight cutter in an ordinary gear cutting engine, and then to give the teeth the proper curved outlines by means of a hob made particularly for the purpose, and revolved in the nicks or spaces made by the gear cutter. It has been ascertained, however, that it is impossible to cut an accurate worm wheel by this process, for the reason that the hob changes the sides of the teeth from a straight line to a helical form, and as the hob has so much metal to remove and also to revolve the wheel, that the motion given to the wheel is far from being accurate. The machine illustrated is intended to cut the teeth in the surface of the wheel as well as to cut the worm or screw perfectly, without regard to size or pitch.

The Hindley screw has much more bearing surface, at least four times as much, as the ordinary worm gearing, a large bearing surface that adds considerably to the durability of the screw and greatly reduces friction. This is a very important advantage, as the common worm has been known to cut away and become completely destroyed in a few hours. The cutting and wearing away of the worm greatly damages the teeth in the worm wheel. The threads in the Hindley screw can be made as long as required, not being confined to any particular length or shape, for the reason that they all point to one common center. For a dividing-wheel, where exact divisions are wanted, the teeth and screw can be made very short, even should a coarse pitch be required. A much steadier motion is obtained where a large number of teeth have a bearing at one and the same time, which makes it valuable for many kinds of machinery, such as elevators, hoisting machinery, cranes, derricks, jackscrews, and all machinery where great steadiness of speed is required.

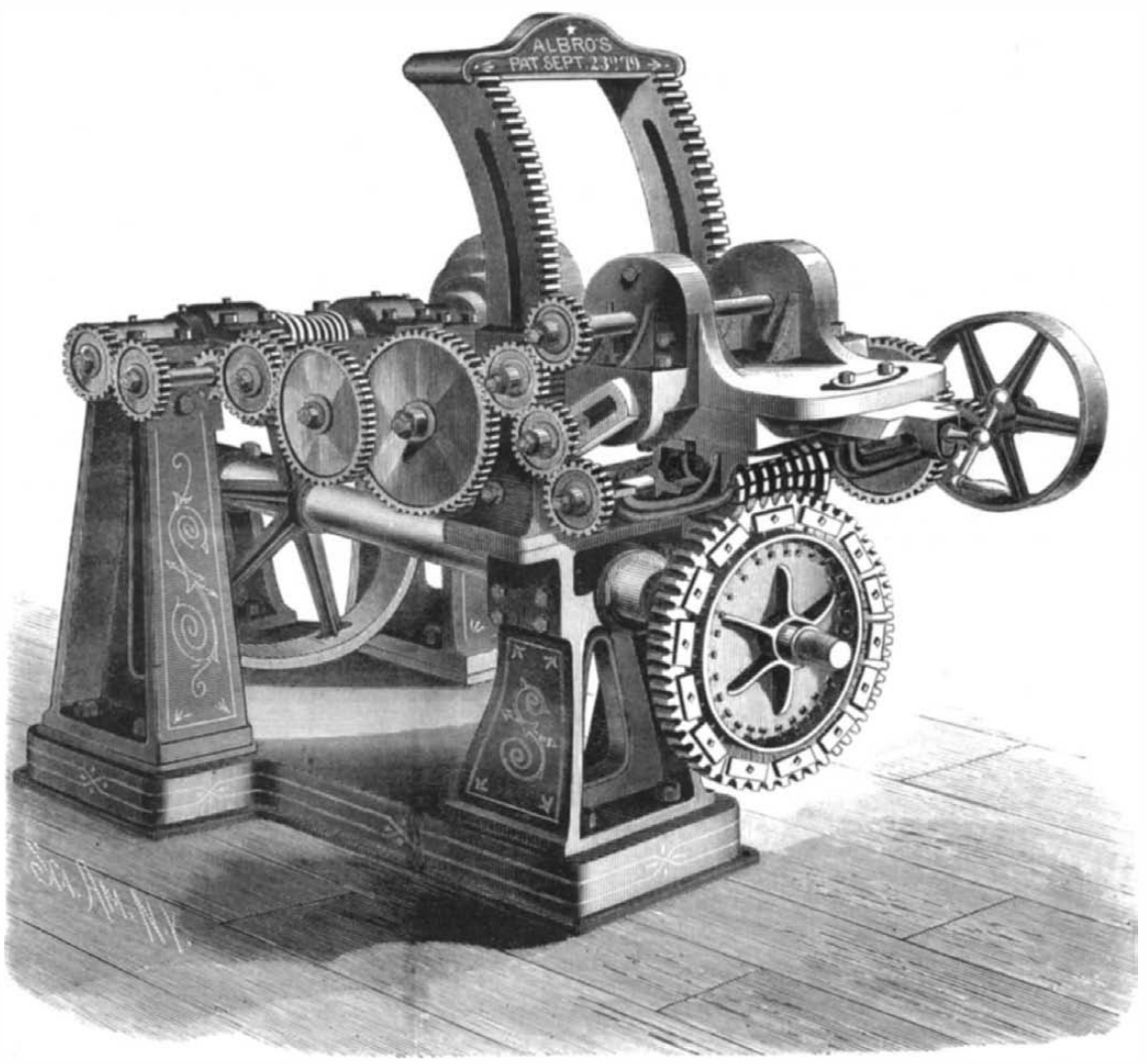
This form of worm gearing is very strong and capable of resisting any strain that may be brought to bear upon it.

The machine has two columns or standards, one on each side at the rear of the bedplate. On the top of these columns are journal boxes which carry the master worm or screw shaft. This worm or screw drives the master worm wheel, which is directly underneath the worm, and is fitted to the main spindle which runs the entire length of the bedplate, and is held in place by two shorter standards at the front and rear of the machine. The main spindle has a taper hole in the forward end for receiving the steel spindles carrying the gears to be cut.

On the inner side of the two long columns, and central with the journals, there are two trunnions on which the swing frame moves. This swing frame is made strong and rigid, and supports at its free end a compound slide rest by a flexible joint. The slide rest can be swung or revolved completely. This motion is necessary in order to cut bevel and spur gearing. Underneath the slide rest is journaled the cutter shaft, which extends across the slide rest and projects far enough to receive the proper gearing to revolve the master worm shaft. This slide rest has a movement of sixteen inches, and is swiveled in such a manner that spiral and skew gearing may be cut.

Accurate worm wheels are cut automatically in this machine in the following manner: The blanks to be cut are fastened on the steel spindle at the front of the machine, a Hindley worm cutter or hob is fastened on the cutter shaft, and the cutter shaft is connected with the master worm shaft by a train of gearing supported by the swing frame, and in such a manner that they will always remain in gear for the reason that the swing frame turns on the axis of the master worm shaft. Motion is given to the cutter shaft by a spur wheel, pinion, and pulley, and the train of gearing imparts motion to the master worm shaft, which causes the master wheel and main spindle with the blank fastened on the end to revolve. Both blank and hob or Hindley worm cutter being revolved uniformly, the teeth are cut on the blank with uniformity and accuracy. While the machine is in motion the free end of the swing frame continually falls, and the machine cuts the teeth in the blank to a depth regulated by a stop motion underneath the swing frame.

This machine is especially arranged to cut the Hindley screw. The Hindley blank is fastened on the cutter shaft, and a stiff flange or plate carrying hardened steel tools, the ends of which are made the proper shape and the proper distance from each other, is fitted to the main spindle. Arranged in this way the order of things is reversed, and instead of the hob cutting the wheel, as before shown, the teeth on the sides of the flange are cutting the worm. The pitch of the hob or cutter is made to correspond with the number of teeth to be cut in the blank, and the machine must be geared in such a manner that the cutter makes a revolution to each tooth to be cut. An ordinary cutter is used and fitted to the cutter shaft for cutting spurs, bevels, miters, spirals, etc. The shaft shown at flexible joint controls the automatic feed motion in cutting spu gears, etc. Near the front of the machine there are two toothed sectors, and the swing frame is mortised to allow its movement up and down. At the front of these sectors, and on the top of the swing frame, there is a shaft carrying two pinions which engage with the teeth on the face of the sectors.



THE ALBRO PATENT HINDLEY SCREW AND GEAR CUTTER.

This shaft is driven by a system of worms and wheels, and effects the downward feeding. A crank is fastened to the end of this shaft to raise or lower the swing frame to any required position.

Further information in regard to this useful invention may be obtained by addressing Messrs. Clem & Morse, 413 Cherry street, Philadelphia, Pa.

The Strength of Wooden Columns.

Some important tests of the strength of wooden columns, such as are in common use in the construction of cotton and woolen mills, have lately been made at the instance of Mr. Atkinson, President of the Boston Manufacturers' Mutual Fire Insurance Company. The tests were made with the testing machine at the Watertown Arsenal. The formulas in use for computing the strength of wooden columns are based on tests applied to columns of about two inches on a side and four or five feet long. The new tests were made with columns of pine and oak of the size and length used in actual construction. All but two were round, hollow columns, of from eight to eleven inches diameter, the two being about nine inches square. The greatest amount of pressure exerted in any case was about 265,000 pounds. The tests have disclosed frequent instances of defective boring in the columns. The object in boring is to open an air passage through the heart of the stick for the prevention of dry rot after it is in position in the building. It is essential, of course, that the bore should extend from end to end, but this has not always been effected. The sticks were bored first from one end and then from the other and the borings have sometimes failed to meet in the middle of the stick. The tests also show that to taper the sticks is a mistake, inasmuch as it weakens the column more than has heretofore been estimated. Reasons for exercising more caution in other respects in the construction and adjustment of wooden columns in building have also been disclosed.

Underground Telegraph Wires in Germany.

The *Deutscher Reichs Anzeiger* (September 28) gives the following details of the subterranean telegraph lines at present in working in Germany. The total length of cable is 3,642 miles, the greater portion of which contains seven wires, though on some of the minor lines a four-wire cable is used. 10,170 tons of iron, three-quarters of a ton of copper wire, and 1,836 tons of gutta percha casing were employed on the system. 70 rivers were traversed, requiring between seven and eight miles of subaqueous cable. The first line constructed was begun on March 14, 1876, and the latest (that from Cologne to Aix-la-Chapelle), which is included in the report, was completed on June 26 of the present year.

ENGINEERING INVENTIONS.

Mr. Michael B. O'Neill, of Halifax, N. S., has patented an improved ash pan for locomotives. In this improvement the bottom of the ash box is formed of a series of end-pivoted pans, preferably of semicircular form in their transverse section, and with overlapping flanges on their upper edges. These pans are connected at one of their ends with a bar which has an attached crank movement that is operated by a rod from the cab, for the purpose of turning and dumping the pans and of returning them again to their receiving position. A perforated pipe connected with the water tank, and provided with a cock, passes over the pans for wetting down the ashes before emptying them. By this construction the ashes can be emptied at any time or place. Being wetted, they will not set fire to bridges or sleepers, and being frequently emptied will serve as ballast and prevent growth of grass. The readiness with which the ashes may be cleaned out while the locomotive is in motion is of great advantage. An increased draught results from the ash box being emptied frequently, thus saving labor and fuel.

An improved feed-water heater for steam boilers has been patented, the principal features of which are any number of drums arranged below and at the rear end of the boiler, and which are connected by pipes with the lower water space of the boiler, also, by a series of upwardly inclining pipes, with uprights, situated at the front end of the boiler, and connecting by pipes with the steam space of the latter. These drums serve both as feed water receivers and as mud receptacles, and are provided with water-supply pipes and blow-off connections. They and most of their pipes are exposed to the action of the fire, and consequently both heat the feed water and assist in generating steam, likewise promote circulation within the boiler. The patentee is Mr. George W. Sloane, of Brooklyn (Greenpoint P. O.), N. Y.

Mr. William C. Waring, of Yonkers, N. Y., has patented an improvement in fulling mills. In this improvement the hinged lining plate in the forward portion of the fulling box is vibrated automatically by a crank motion derived from the cam roller shaft which actuates the beater, for the purpose of insuring the dislodgment of the material from the place into which it has been driven by the beater, and for regularly turning the material so that it will be struck by the beater in a new place. Manual labor, too, for vibrating said lining is dispensed with.

The Electric Light vs. Gas in Theaters.

It is said that a marked improvement has been noticed in the acoustic properties of the Grand Opera House, Paris, since the introduction of the electric light. A layer of heated gases acts as a screen for sound, hence the volumes of hot fumes arising from the old gas foot-lights obstructed and marred, to some extent, the voices of the singers. With the electric light, inclosed in air-tight bulbs, no fumes can be emitted, and very little heat is given off. Hence it benefits the ear as well as the eye.

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DYNAMIC ELECTRICITY.

THE DEPOLARIZATION OF ELECTRODES.

BY GEO. M. HOPKINS.

Having explained the causes of the enfeeblement of currents in galvanic batteries in a former paper,* I will describe some of the methods in use for preventing the principal cause, viz., that of the polarization of the negative electrode. In all single fluid batteries this necessarily takes place to some extent, whatever precautions may be adopted for its prevention. The means of depolarizing single fluid batteries are mechanical, and consist in the agitation of the exciting fluid by gravity, as in the fountain battery, by air jets, as practiced by Grenet and Byrne, by stirring the fluid by mechanical means, by rotating or swinging the electrodes, and by roughening the electrode, as in the case of Smee's battery, in which the platinum plate is covered with a deposit of finely divided platinum.

In single fluid batteries the polarization of the negative plate may be greatly retarded by enlarging it so as to afford a great surface for the dissipation of the hydrogen. In two fluid batteries the depolarization is effected by chemical means, and perhaps more perfectly in the sulphate of copper batteries than any other.

In all single fluid batteries the oxidation of the zinc liberates hydrogen at the negative plate, and the hydrogen rapidly reduces the power of the battery in the manner explained in the former paper. In Smee's battery the microscopic points formed by the roughened platinum surface facilitate the escape of hydrogen, and in this way may tend to maintain the power of the element.

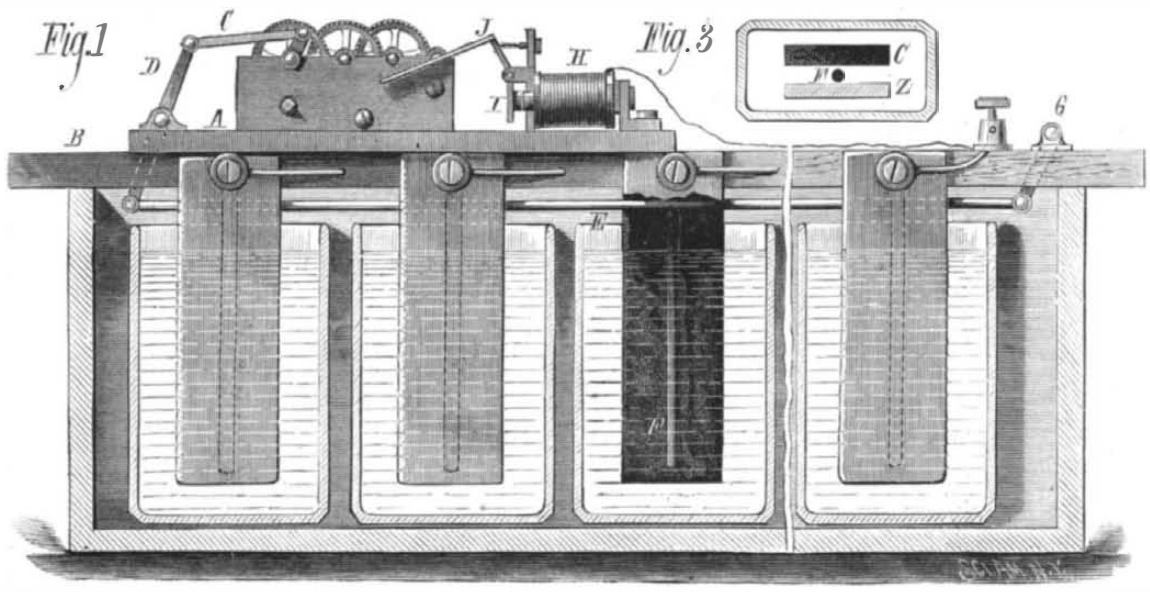
In the Grenet battery the negative plate quickly polarizes, rendering the battery unfit for uses of more than a few minutes' duration. However, the agitation of the exciting fluid by the withdrawal and replacement of the zinc restores the battery to its normal strength. Grenet agitated the exciting fluid by means of air blown in through glass tubes, as shown in Fig. 4. This prevents polarization to a great extent, and renders the battery very active. Dr. Byrne, of Brooklyn, adopted this plan of depolarization in his battery with remarkable results.

On page 182 of the current volume of the SCIENTIFIC AMERICAN is shown a zinc-carbon battery employing the bichromate of potash solution as an excitant, and arranged for the introduction of the solution to the cells by air pressure, which may also be made to agitate the solution. This is a very convenient form of battery for experimental purposes and for uses of short duration, as it can be made to yield a strong current while the exciting fluid lasts. The air in all these cases acts only as a mechanical agitator. The fountain battery, described and illustrated on page 150, exhibits another practical method of mechanical depolarization.

Figs. 1, 2, and 3 of the annexed engravings show a purely mechanical agitator, consisting of a system of spring-acted stirrers, controlled by an electro-magnet of high resistance in a derived circuit. This magnet absorbs but an exceedingly small proportion of the current, and has only sufficient power to move the lever controlling the spring motor.

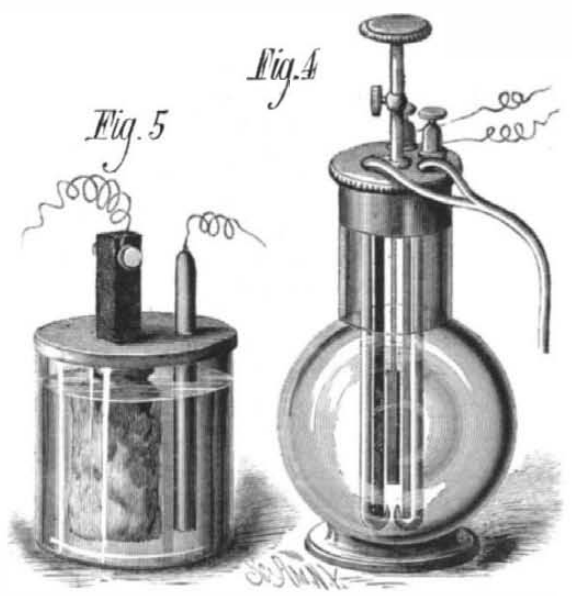
This motor, which may be of the cheaper class, is mounted on a base, A, secured to two parallel bars, B, carrying the zinc and carbon plates, *z c*, of the battery. These plates are placed flat against the bars, B, and secured by screws and washers. The zinc of one element is connected with the carbon of the next by a wire passing diagonally through the bar, and the first zinc and last carbon are connected with the binding posts at the ends of the bars, B.

The second shaft in the train of gearing is provided with a crank connected by a rod, C, with the lever, D, which is fastened to a rock shaft, and connected with the bar, E, extending the whole length of the battery between the zinc and carbon of each element, and carries a series of vertical rods, F, of vulcanite, one such rod being located between the zinc and carbon plates of each element. The zinc in one of the elements is broken away in the engraving to show this rod. A swinging arm, G, supports the extremity of the rod, E. A high resistance magnet, H, mounted on the base, A, is connected with the two binding posts of the battery, so as to receive a small portion of the current. The armature attached to the lever, I, when drawn against the poles of the magnet brings the lever, I, into engagement with the fan, J, which is the last element in the train of gearing composing the spring motor. A light retractile spring draws the lever, I, away from the fan, J, and removes the armature from the magnet when the power of the battery is reduced to a certain limit. The spring motor, being free to act, oscillates the rods, F, and by stirring the exciting liquid, disengages the hydrogen from the plates, and brings fresh liquid into contact with the zinc and carbon and restores the strength of the battery, when the armature of the magnet, H, will be acted upon, bringing the lever, I, into engagement with the fan, J, and stopping the action of the spring motor until the current is again weakened, when the operation just described will be repeated.



DEPOLARIZATION OF ELECTRODES BY MECHANICAL AGITATION.

In this way the strength of the battery will be maintained within certain limits, until the liquid is exhausted. Of course this system may be extended sidewise or lengthwise as much as may be desired.



GRENET BATTERY, WITH AIR TUBES.—CHLORIDE OF SODIUM BATTERY.

At least, all batteries employing mechanical means of depolarization, with, perhaps, the exception of Smee's, are only adapted to uses requiring a very strong current for a limited time.

The enlargement of the surface of the negative plate has great advantages, as it affords an increased surface for the accumulation or dissipation of the hydrogen.

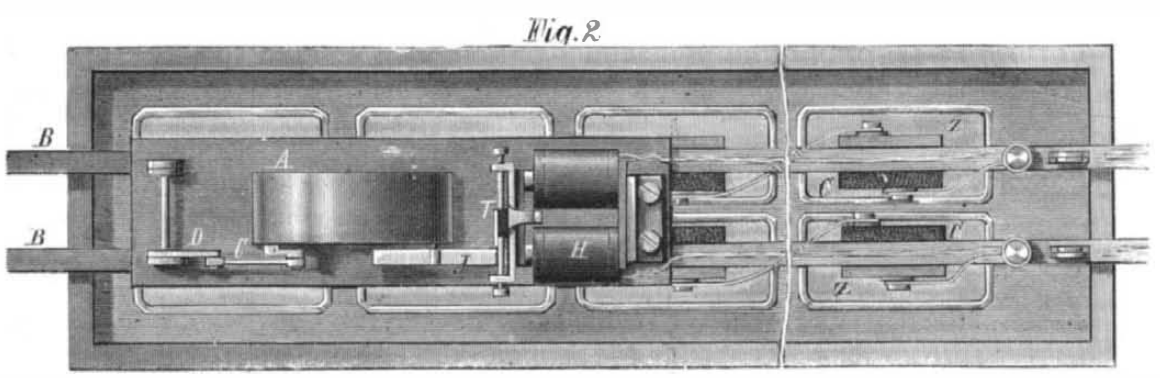
A very simple example of a battery with enlarged negative plate is shown in Fig. 5. A carbon rod is placed in a Canton flannel bag and surrounded with pieces of broken carbon about half inch square. The bag is tied around the carbon rod and placed in a jar partly filled with a strong solution of common salt. The zinc consists of a round rod about three-eighths of an inch in diameter, like that used in the Leclanche battery. The large carbon surface in this battery polarizes very slowly. One cell of the battery is sufficient to ring a bell on a short circuit.

The chemical method of disposing of the hydrogen in batteries is theoretically and practically the best, and the best example of the most perfect action of this character is found in the Daniell battery, in which the hydrogen resulting from the action of the dilute acid on the zinc is liberated on the surface of the copper plate, where it reduces the sulphate of copper, forming sulphuric acid and metallic copper, the latter being deposited on the surface of the copper plate. So long as sulphate of copper is present in the battery this action continues, and the current from the battery remains constant.

In the Grove battery the hydrogen at the platinum plate decomposes the nitric acid forming hyponitrous acid, which is either dissolved or disengaged as nitrous fumes. In the Bunsen battery the action is the same as in the Grove. When the bichromate of potassium solution is used in the Bunsen battery the hydrogen reduces the chromic acid to oxide of chromium, which remains in solution.

In the gravity battery the action is the same as that of the Daniell. The sulphate of zinc formed in the battery floats on the solution of sulphate of copper owing to its lower density. In the Leclanche battery the hydrogen of the decomposed water unites with the oxygen of the manganese.

The depolarization of batteries has been the subject of a great deal of thought and experiment, and, although the discoveries of Daniell, Grove, Bunsen, Leclanché, and other prominent investigators excite our admiration, the subject still affords a wide field for investigation.



PLAN OF DEPOLARIZING APPARATUS.

* Page 55, current volume, SCIENTIFIC AMERICAN.

Communicating with Wrecked Vessels.

Messrs. Low and Duff, engineers, Dundee, have just made an important improvement in connection with apparatus for communicating with wrecked vessels. It is a new gun which they tried at Monifieth recently, with marked success. The gun is 2 feet long, with a bore 2½ inches, and it is so constructed that the line which is to be fired from it passes through the back end of the gun. In the experiments made recently the line was shot 400 yards with two ounces of powder, which would have sent it further had the line used on the occasion been longer. The cord is coiled in the form of a cop and put inside of a steel canister. This canister is fired out of the gun, and leaves the line streaming behind it. The distance to be covered is simply a question of size of gun and canister. The gun was sent to Birmingham and tested in the most thorough manner in the proof-house there. The twine used in the experiment was made of flax, and carried 200 lb. dead weight with a length of 6 feet of twine.

The Citadel Park of Barcelona.

Marked indications of the growing revival of enterprise and industry of Spain are shown in the old seaport city of Barcelona, in the northeastern corner of the kingdom, on the Mediterranean. It is a city of about 250,000 inhabitants, and a good business place; in fact it may be styled the New York of Spain. We recently chronicled the introduction there of the electric light for street illumination. A recent number of *La Ilustracion*, of Madrid, contains a large and beautiful picture representing different portions of a new park lately inaugurated in Barcelona. Its area is nearly a hundred acres, and was formerly occupied by the decaying walls and ruined ramparts of the old citadel. Here also was the old state prison. These ancient works, relics and mementos of barbarous times, have all given place to the new park of the citadel, filled with marble fountains, beautiful walks, grottoes, cascades, flowery arbors, shade trees, and other adornments. At the principal entrance the following inscription is set up:

"These parks and gardens being the property of all the citizens, they are all interested in their preservation; and they are accordingly placed under their especial care and vigilance. Signed: The Constitutional Alcalde of Barcelona."

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RECENT INVENTIONS.

Mr. Nelson G. Northup, of Eaton Rapids, Mich., has patented a simple but improved extension step for cars. The object of this invention is to provide a convenient device whereby the steps of cars and other vehicles may, when desired, be quickly lengthened and shortened. The invention consists of a step secured to and combined with the ordinary car or vehicle steps, and made vertically adjustable for the purpose of extending the steps downward to any desired point, and thus affording an auxiliary step under the lower fixed step of the car or vehicle. This auxiliary step may be raised or lowered by means of hangers arranged to slide up and down within tubular guides on the outer faces of the sides of the regular steps, said hangers being formed with racks, with which pinions on a cross shaft operated by a handle or crank are made to engage.

An improved rocking grate, especially applicable to loco motive engines, and designed to prevent ice from collecting on the under side of the grate when the engine is running through snow, has been patented by Mr. John R. Fish, of Grand Rapids, Mich. The invention consists in a combination, in a rocking grate, of bars arched from their ends to their centers with bars which are straight on both their upper and lower faces, each and all of the several bars being journaled and formed with vertical parallel ribs on their sides, and preferably provided with depending legs connected with a shaker bar arranged to extend through the ash pan. The crowns of the arched bars, which alternate with the straight bars, extend considerably above the upper faces of the latter, thus exposing the arched bars to a high degree of heat, which prevents the accumulation of snow and formation of ice thereon. A free passage for air between the bars is insured, fine coal may be burned on the grate, and the latter be readily rocked.

An improvement in machines for the manufacture of ice, which is both economical and gives a large working capacity, has been patented by Mr. Charles W. Gelett, of Oakland, Cal. This invention relates to that part of an ice machine known as the "congealer;" and it consists of a thin, hollow, rectangular plate having stops at intervals between the two freezing surfaces, so that the flow of the refrigerant will meet with more or less impediment in passing through the plate, and a more rapid congelation of the water which is directed upon the outside of the plates will take place. These stops are preferably arranged in rows, the stops of each row being at an angle of forty-five degrees to those of the next row, thus keeping up a more thorough agitation of the refrigerating vapor and insuring its contact with the entire side surfaces of the congealer. Any number of such congealers are so arranged within a frame and combined with the gas or vapor reservoir, air pump, pipes, and water-spraying devices of the machine, that ice is formed upon both sides of said congealers.

Mr. Hans J. Müller, of New York city, has patented an improved ore separator. The object of this invention is to provide a new and improved device for separating particles of iron, steel, etc., from granulated or pulverized ore or other material. In this apparatus the pulverized material is placed in a hopper and dropped from there upon a platform or shelf which is vibrated by a ratchet wheel, fast on the shaft of a rotating magnetized cylinder, and engaging with a lever, on the shaft of which is an arm that connects with the shelf. The sand or granulated material slides down said shelf, which is slightly inclined. The particles of iron or steel cling to the cylinder and are scraped from the same by a plate, and drop into a slot or into a receptacle below it, while the particles of sand or granulated material drop from the edge of the shelf into another slot or receptacle beneath it. The apparatus, although simple, is effective.

Mr. James B. Gillham, of Merritt, Ill., has patented an improved car coupling. This invention pertains to self-couplers; and it consists of a drawhead having tongues projecting rearward into corresponding sockets or slots in the drawbar and carrying springs on their ends, and provided, also, with a square collar fitting over the end of the drawbar, said tongues having vertical perforations corresponding with the openings in the drawbar for the reception of the coupling pin, which latter, when coupling, holds both drawhead and coupling link in position; and it further consists of a coupling pin reduced near its point and having a conical extremity for use in connection with the drawhead and drawbar constructed as above, whereby the pin is prevented from being too far withdrawn and the drawhead is retained in position. The pin may be uncoupled, and held when disengaged by an attached rod reaching above the top of the car and capable of suspension on a pin projecting from the front of the car. The invention is an ingenious one.

Mr. Justin J. Langles, of New Orleans, La., has patented a simple but useful adjunct to show boxes. The object of this invention is to provide an ornamental and removable cover for grocery and other boxes, which, while exposing the contents of the box to view, shall be preservative of its contents, and is provided with a lid that may be automatically held open at any point. The invention comprises a frame, which is preferably made of ornamental wood, constructed to fit over and receive within it the upper edges of the box, and provided with inside strips which support the frame upon the top of the box. A lid, which may be also of ornamental wood and has a glass top, is attached to the frame by hinges formed of angular plates which bind the corners of the lid and frame. Pivoted to this lid is an arm, and pivoted to one of the side bars of the frame is a slotted plate, through which said arm passes at an angle, that causes the plate to act as a clutch upon the downward movement of the arm, except when specially relieved, but permits of a free upward movement of the arm when raising the lid.

Mr. William Hassel, of Brussels, Ill., has patented an improved animal shears. The device comprises a sharp-edged tooth plate arranged to slide on a similar sharp-edged toothed plate which is adjustably fastened to a like toothed bed-plate. This bed-plate has a rigid handle that is provided with a spring which presses against a handle pivoted to the bed-plate and which has a connecting bar pivoted to its upper end. This connecting bar is attached to a strip arranged to slide in a longitudinally slotted guide plate on the bed plate, and having the sliding knife-plate adjustably fastened to it. In this improved shears for clipping wool, etc., a clean cut, with but little risk of injury to the animal, is practicable, and the cutting blades or plates of the instrument may readily be removed when required to be sharpened or replaced.

A novel improvement in bathing tubs has been patented by Mr. Henry Costello, of Brooklyn, N. Y. The invention consists of a corrugated or roughened plate or band of rubber, fabric of wool, horsehair, or other suitable material, permanently or adjustably fixed in or on the sloping back-piece of the tub, where the bather's back naturally rests, so that by gently moving the body from side to side the bather may, with little effort, rub and cleanse his back. In some instances said plate may be an insulated metal one, and an electric current be passed through it, which will have a therapeutic effect on the bather.

A practicable and very useful improvement in drag-saws has been patented by Mr. Marion L. Nichols, of Center Township, Mich. This invention relates to portable sawing machines, and is more particularly applicable to sawing trees or logs. It may be operated by hand through a crank or handle and suitable gearing connected with a reciprocating saw. The invention consists in a combination with the main frame of a saw carrier adjustable about a vertical pivot on a block supported by horizontal trunnions on top of the main frame, locking nuts and convenient adjusting devices being provided to hold the saw carrier in any desired position. The apparatus may be used to saw either vertically, horizontally, or in any intermediate direction, or it may have a universal motion. The feed of the saw may be effected by moving its carrier with one hand while the other hand is applied to reciprocating the saw.

An improvement in ventilators for dwellings and other structures, and which is somewhat diversified in its application, has been patented by Mr. Joseph Patchett, of Lawrence, Mass. The leading peculiarities of this ventilator are the covering of the inlet flue at its top and forming it with side openings, and arranging the top or outer opening of the outlet flue on a higher level than the side opening of the inlet flue, also surrounding the top of both flues with a rim which is secured a small distance from the upper ends of the flues, likewise providing the upper end of either or both flues with a perforated flange and deflector, and other parts or details, the whole serving to give to the outgoing current as direct a course as possible and to provide a circuitous passage for the incoming current. By the use of this improved ventilator the vitiated air of a room or building will be rapidly replaced by the external air without creating cold currents or draughts.

Making Carbon Transparencies.

The method to be described for making transparencies for this purpose is equally applicable to the production of those for the magic lantern, but with this difference, namely, that the pictures must not be printed nearly so deeply, otherwise they will prove too dark and heavy when projected on the screen. We will assume that the negatives are of the ordinary density, and that the tissue selected is that specially prepared for the purpose; but whether it be, or whether another containing less pigment be chosen—the method of using it is the same in either case. One great precaution to be taken throughout all the operations is cleanliness and the avoidance of floating particles, either in the atmosphere or in the developing waters. For sensitizing the tissue a bath should be prepared as follows: Bichromate of potash, 1 ounce; water, 1 pint; liquor ammonia, 15 minims.

When the bichromate is dissolved the ammonia is added and the solution carefully filtered. At this season, when the light is bad or the negatives contain very strong contrasts, the proportion of bichromate may with advantage be increased to one ounce and a quarter and the ammonia to twenty minims, provided the tissue is treated in the way we direct. But if it be simply removed from the bath and suspended to dry in the ordinary manner this proportion will be too great, whatever the character of the negative may happen to be.

The bath being ready, we take some glass plates of convenient size—say twelve inches by ten, or larger—and having rubbed them over with powdered talc and finally dusted them, they are coated with plain collodion of not too horny a kind, which is allowed to set well. The plates are then washed in a dish of water or under the tap to free the film from the ether and alcohol, and are then reared on end to drain somewhat closely (but not to dry) in some place free from dust. It must be borne in mind that any particles which may be allowed to subside on this film or on the tissue when sensitizing will show as specks in the finished transparency. The plates being ready the tissue is cut into pieces rather smaller than the glass plates, and is then sensitized by immersion in the bichromate solution, which should have been poured into a porcelain dish.

After immersion for a time sufficient to render the tissue quite limp and pliable it is removed and placed face downward on the collodionized glass, and the superfluous solution removed by passing a squeegee somewhat firmly over the back of the tissue. This will also expel the air bubbles and insure perfect contact between the tissue and the collodion film. The plates carrying the tissue are now placed in a warm and dry situation. When the tissue is dry, and not before, a penknife is passed round the edges and the tissue stripped off, which will, of course, bring the collodion film with it, and will possess the polished surface of the glass. It may then be cut into convenient sizes and preserved in an air-tight case; but a better plan is to allow it to remain on the glass until required for use.

The advantages of this mode of preparing the tissue are manifold. First, the tissue dries from the back; hence the front—that part which forms the picture—remains moist the longest, and, consequently, is less soluble then that in contact with the paper. Secondly, dust has no opportunity of settling on the gelatinous surface during drying. Thirdly, the tissue will not require to be coated with collodion before mounting for development, which it frequently does if it be not in good working condition. Also, its surface being perfectly smooth, better contact with the negative is secured during the printing. It is important that the tissue should be thoroughly dry before it is placed on the negative, or small dark patches—"damp marks"—may be produced. The printing should be carried to at least double the depth required for an ordinary paper print, and, in some instances, as much as three times the exposure may be given with advantage, the development being carried to a proportionate extent to compensate for it. In the finished print no part of the picture should be clear glass, except, perhaps, the *extreme* highest light. We are now speaking of transparencies for enlarging from. For the magic lantern the printing should not be carried nearly so far; from one and a half times to twice the depth for a paper print will be ample.

We now come to the development. Some plates should be in readiness prepared with one of the substrata. That with the chrome alum and gelatine or the bichromate of potash and gelatine, with subsequent exposure to light, will answer the purpose equally well, it being simply a matter of taste or convenience which is employed. The exposed tissue, together with one of the prepared plates, is now immersed in clean cold water until the tissue becomes limp. The two are then brought into contact under the water, removed, and well squeegeed, taking care that no particles of foreign matter get inclosed between them. After remaining for five or ten minutes the print is immersed in water at a temperature of about 90°, and the development conducted as in ordinary carbon printing, except that toward the end of the operation the temperature of the water may be much increased with advantage.

When the development is complete the transparencies are placed in a dish of filtered water, where they are allowed to soak for ten minutes or a quarter of an hour. They are then taken out and placed on blotting-paper or in a rack to dry. It is very important that the gelatinous surface should be protected from dust during the drying, as any particles getting into contact with it will be sure to adhere and show in the enlargement. As the printing is carried to so great a depth and the development effected with hotter water than usual the film is rendered sufficiently insoluble for all practical purposes. Hence the prints will not require fixing in alum solution.—*British Journal of Photography.*

Iron from Black Sand.

A valuable iron ore, in the form of black sand, exists in large deposits on the east beach of Block Island, R. I. D. C. McCotter uses it in making steel. New processes and a machine for separating the iron from the sand have been invented, which clear 100 tons of sand in ten hours. The separation is done by magnets. As the mineral ore pours out of the chutes it is placed in bags, each holding 112 pounds, and shipped to Hoboken, and thence to Rockaway. N. J. There it is loaded on wagons and afterward taken to the furnace. It is mixed with charcoal, taken by elevator into the hopper, and distributed into sixteen large cylinders holding about ten tons, and heated to a red heat; then it is tapped at the bottom and let down into a large oven still kept at a red heat, and there burns out all the charcoal. The iron doors are opened, the sand is hauled out into a large charcoal fire, and forms a mass which is hammered by large steam hammers into blooms, weighing from 200 to 300 pounds.

Nutritive Value of Gelatin.

A dog weighing 11 kilos was kept for three days fasting, and received then daily for nine days 45 grms. gelatin and 200 c.c. water. The excretion of nitrogen in the urine during the fast was daily 2·385 grms.; during the gelatin diet, 7·105 grms. This latter quantity exceeded that present in the daily ration by 0·785 grm. Hence during the gelatin diet 1·600 grms. of the nitrogen of the system was economized, and accordingly the animal lost weight in a smaller proportion than when fasting. The experiment was repeated with an increase of the daily ration of gelatin to 50 grms., but the results were still in accordance with those of Voit, that gelatin indeed economizes albuminoids, but can never entirely cover the waste of albuminoids in the system, and has therefore a much lower dietetic value than albumen.—*N. P. Oerum and Dr. Ditzel.*

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THE FLYING SQUIRREL.

BY R. W. SEISS.

The flying squirrel—*Sciuropterus volans* (L.), Coues—may be distinguished by the following characters: Head short and rounded; nose blunt; eyes large and prominent; a membrane extending from fore to hind limb on both sides of the body; tail flat and rounded at the tip; general color ashy gray; beneath, cream color; length ten inches.

The favorite home of this species is a woodpecker's hole in some tall tree, not always a deserted one, however, for during the past summer, while walking through some woodlands, in Western Maryland, I noticed a large sycamore tree with several holes of the red-headed woodpecker (*Melanerpes erythrocephalus*) in one of its branches, and upon my companion striking the trunk with a stone, several "red headers" flew out followed by four flying squirrels, which floated out one after the other. It also sometimes shares its abode with screech-owls and bats. But not only does the flying squirrel live in trees; I have observed numerous instances of their having taken possession of marten boxes, crannies in rocks, the eaves of houses, etc.

Some time ago, while staying at a friend's house in Hunterdon county, N. J., I discovered a nest of this species built between the closed Venetian shutter and window of an unused room, the mother gaining admission through the slats. She was quite tame, allowing you to advance within a few feet of the window before making her escape. We made several efforts to capture her without success, and finally, becoming tired of being molested, she decamped with her whole family during the night. The nest contained five young only a few days old.

This squirrel has two litters in a season, and from three to six at a birth; they are blind for about three weeks after their *entrée* into the world. The female carries the young by doubling it up with her fore feet and mouth until she can grasp the thigh and neck. She shows great affection for her offspring, preferring captivity to deserting them.

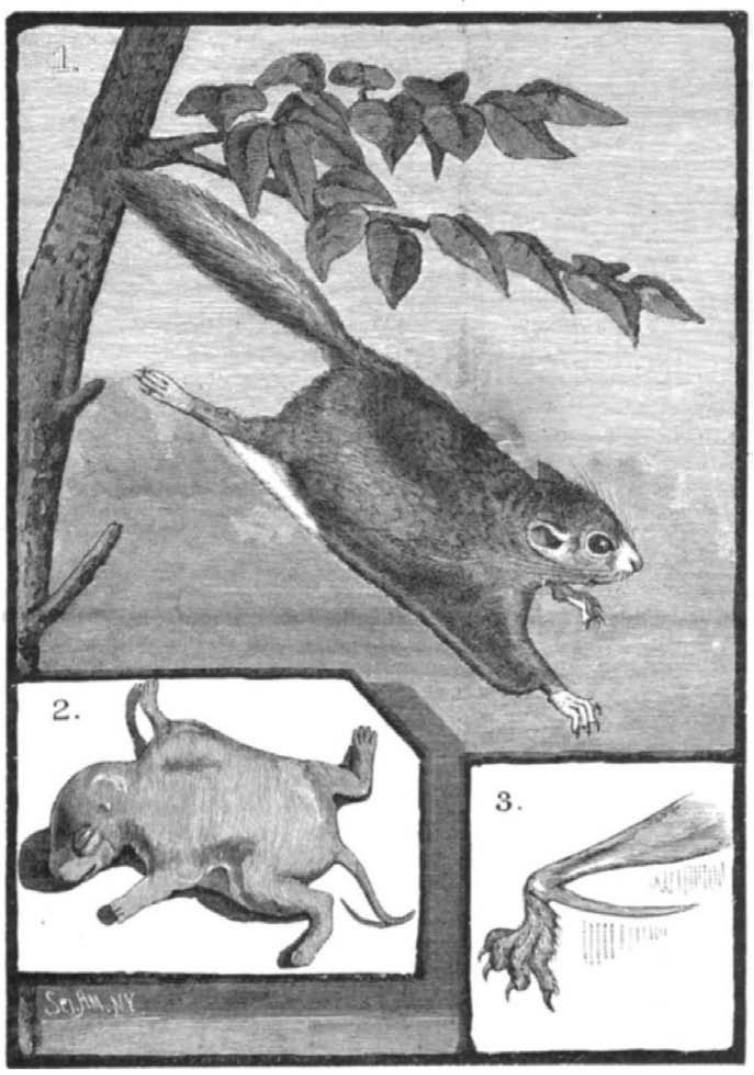
The usual food of the flying squirrel consists of various kinds of seeds, nuts, and tree buds, but Audubon gives several instances which came under his observation, where it was caught in traps baited with meat, and also an account of several tame ones which devoured a fine grossbeak (*Corythus enucleator*) in a single night.

The so-called "flying" of this little animal is performed in the following manner: first ascending to a height, it springs out into the air, at the same moment extending the fore legs forward and outward and the hind legs outward and backward, thus stretching the membrane to its fullest extent. In this way it *floats* from tree to tree without any motion of its "wings." The impetus gained enables it to ascend a short distance in a curved line and alight on the object aimed at head up. These flights often measure fifty yards or even more.

Flying squirrels are easily captured in almost any kind of trap baited with hickory or hazel nuts; the trap, however, must be allowed to set over night.

It would be hard to find a more gentle or amusing pet. I have never known it to bite when caught, and it becomes tame in a few hours.

A friend of mine once kept two females for several months; in the evenings they were allowed perfect liberty, and presented a most pleasing sight as they gamboled round the room. A favorite trick of one of them was to bury nuts among the wavy tresses of her mistress, returning the next day to find them, and appearing much surprised when they were not to be found. Fig. 1 represents an adult *Sciuropterus;* Fig. 2 a young one about four days old; Fig. 3 is a dissection of the fore leg (natural size), showing the peculiar cartilage which is articulated to the ulnar side of the carpus; it assists to extend the flying membrane.



THE FLYING SQUIRREL.

THE TAPE WORM.

Most of my readers know that the domestic pig is subject to a disease known as "measles," in which the muscles are more or less filled with *cysts*, which render the pork unfit for food; but I think few are acquainted with its cause.

Man, it is well known, is occasionally infested by a parasite—the so-called "tape worm" (*Tænia solium*)—which may be described as having a tape-like body of varying length, with a differentiated "head" or *scolex* at one extremity.

This apparently single animal is in reality a colony of mothers and daughters, the scolex being the parent of all.

This "head" is provided with a *rostellum*, or, as it might be called, proboscis, encircled by a crown of hooks, below which are the suckers; each segment added to the scolex is a complete individual containing a complicated and perfect reproductive system.

The last segment—*proglottides*—which are filled with eggs, break off at intervals, and either the eggs are set free within the intestine of their host, when they are passed out with the fæces, or the segments themselves are evacuated.

The tape worm feeds on the juices of the bowel by absorbing the nutriment through its skin, aud does not appear to seriously inconvenience its host in any way. In Abyssinia *tænia helminthosis* is constant and general; indeed the animal is there regarded as a sort of hygienic agent and cultivated rather than discouraged, yet the people are healthy; certain it is also that wild animals, almost without exception, harbor at least one species of tape worm as a natural condition.

But what has this to do with "measles?" Now to the point. Let us suppose one of the before-mentioned eggs taken into the stomach of a pig, either by its eating the excrement of a person affected or through the water or air; here it hatches, not into a tape worm, but into an animal of oval form, transparent, contractile, in the middle of which are six stylets arranged in pairs; with these it cuts its way through the tissues until the muscles are reached, when, having arrived at its destination, it stops burrowing and surrounds itself with a sheath.

Here the stylets atrophy, a new and quite different crown of hooks is produced, and the parasite becomes a *cysticercus* or vesicular worm, the cyst being about the size of a hazel nut. This constitutes "measles;" the exhaustion or even death attendant on the disease is caused by the scores, hundreds, or even thousands of animals boring through the tissues; once encysted there is no further suffering or danger.

The cysticercus remains encysted for months or years, or until the piece of flesh enveloping it *is introduced into the stomach of man,* in which case it instantly quits its torpid condition, leaves its sheath, makes its way to the intestine, where, attaching itself by its suckers and hooks, it grows—or rather reproduces—so rapidly that in a few weeks a tape worm of several yards in length is formed, which reproduces eggs, and so *ad infinitum*—from pig to man, from man to pig.

Should the eggs be introduced into man himself or animal other than the hog, the cysticercus penetrates the tissues in the same manner, but it is "not at home," and instead of resting in the muscles it makes its way to other organs, such as the brain, heart, or eye, where its presence has caused in man several instances of insanity and death. Should a piece of meat containing a vesicular worm be eaten by a pig or animal other than man a *tænia* is developed, but it also is "not at home," and does not attain its full development.

Both eggs and cysticerci are killed by a temperature of 200° Fah., so there is no danger in eating well-cooked pork, even if it contains cysticerci.

To prevent hogs contracting "measles" it is only necessary to prevent them having access, either through their food or water, to the secretions of man, and they will not suffer.

Throughout the genus *Tænia* we find this dual life; for instance, the cat has a tape worm, the cysticercus of which she gets from the mouse, and the dog one which he obtains from the sheep.

Philadelphia, Pa.

Intoxicated Bees.

In SCIENTIFIC AMERICAN of October 29, 1881, on page 280, "Botanical Notes," "Milkweed as an Intoxicant" explains what I saw in the summer of 1881. In my garden were several milkweed plants. Bees were very numerous on them: some very lively, others very stupid. I looked for the cause. Saw the longer the bee stayed on the milkweed blossom the more stupid it became. I cultivate the milkweed for greens. When boiled as such they are first rate.

Colebrook, Conn. JAMES B. DUNWELL.

MISCELLANEOUS INVENTIONS.

A cattle car, of decidedly novel and useful construction, has been patented by Mr. Walter I. Tinkham, of Taunton, Mass. The object of this invention is to facilitate the loading, unloading, feeding, and watering of cattle and other animals while being transported. The roof of the car is perforated, preferably by constructing it with a central longitudinal slot, and is made inclining downwardly toward said opening, and beneath the roof a tank is arranged. This construction provides for receiving and carrying a supply of water for the cattle. The water may be drawn from the tank into troughs made capable of being raised and lowered, and, if necessary, provided with upper boxes for holding feed. The door of the car, which is somewhat longer than the height of the car body, has cross cleats on its outer surface, and is fitted to freely slide up and down on rods in such manner that, when lowered, it may be inclined and made to serve as a gang plank.

Mr. Benjamin C. Smith, of Searsport, Me., has patented an improved apparatus for transferring wood-graining; also applicable to transferring any desired design formed by engraving or otherwise upon a plate or block of wood or other material. By this invention the natural graining of wood may be transferred to any desired surface, without applying the color by which the transfer is made to the pattern, so that the depressions of said pattern can never become filled, and the pattern can be used an indefinite number of times. The pattern, which should be a distinctly grained piece of wood, is fixedly supported upon a block or carrier having at its opposite ends rollers, one of which is pressed outward by a spring for the purpose of keeping a band, arranged to pass round said rollers, taut. This endless band may be of rubber-coated cloth, and it is made to travel over the pattern, so that on color being applied by a brush to the outer surface of the band, and a rubber presser being made to bear the latter down on the pattern, the color will be removed from the raised surfaces of the band, and a copy of the graining of the pattern in color will be left on the band. The device at one of its roller ends is then placed against the surface to which the graining is to be transferred, and the block or carrier moved over said surface.

Mr. Charles C. Schill, of Richmond, Ind., has patented an improved flour mill. In this improved mill the grain is placed in a funnel provided with a device for adjusting the discharge, and is delivered on to a revolving plate, from which it is taken by a scraper and passed into a chute that conducts it to a rotating conveyor having wings attached to a vertical shaft. These wings throw the grain with great force between a vertical runner and a vertical fixed stone, which latter is of half-moon shape, with a large semicircular eye at the center, and is fitted in a sliding frame so as to be adjustable toward or from the runner. These stones last much longer and perform their work more perfectly than do vertical stones of the ordinary construction. The runner keeps cooler, as, by reason of the shape of the fixed stone, only one-half of it is in operation at a time, and the stones do not grind upward, which is very injurious to the stones and quality of flour. The conveyor, too, drives in air to cool the stones, and throws off flour dust.

An improved oil-press mat, in which outer wooden leaves lined with wire cloth, and connected by a flexible joint, are combined with one or more middle leaves of wire cloth, secured to said joint, has been patented by Mr. George O. Baker, of Selma, Ala. In using this mat the meal or seed bags are placed between the leaves or aprons in the usual manner. As soon as pressure is applied the wire cloth takes hold by its meshes on the bags, thus effectually holding the bags in place and insuring the even distribution of the seed or meal. The wire cloth also allows free escape of the oil from the bags and out of the mats. This mat can be readily and cheaply manufactured, and possesses great strength and elasticity.

Mr. Isaac B. Potts, of Columbus, Ohio, has patented an improved pipe wrench, consisting of a handle provided with the inclined and serrated stationary jaw at its outer end and the notches on its under side, in combination with a yoke or saddle and movable jaw secured at each end to the said yoke or saddle, and provided with a lip, and the serrated face inclined in an opposite direction to that of the jaw.

Mr. William H. Bryan, of Warm Springs, Va., has patented an improved packet for transporting eggs. In this packet the eggs are carried in boxes mounted one upon another within compartments of a wooden case which is fitted with a spring-supported false bottom. Each of these boxes is constructed with elastic upright partitions formed by doubling a strip of metal upon itself and springing the two walls of the partition apart at the center. These partitions are secured in the box at right angles to each other, and have their ends passed over to the outer surface of the box. They are arranged so that the eggs are kept from contact one with another, and the top and bottom of the box are cushioned. This construction is very simple and secure against breakage of the eggs.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The Holidays, with their agreeable festivities, are approaching. The uppermost thought is, "What shall I buy for Holiday Presents for my friends?" We would cordially suggest Dr. Scott's Electric Hair Brush, advertised on our last outside page, as being a most suitable article. It makes a useful, handsome, and indispensable present.

An experienced Machinist and Engineer desires a situation as superintendent, foreman, or engineer in a machine shop, manufactory, or mill. Address C. V. Tuthill, Station B, Jersey City, N. J.

List of Machinists in United States and Canada, just compiled; price, $10. A. C. Farley & Co., Philadelphia.

For Sale, several patents. Send for circular. Geo. G. Buckland, Tulare City, Cal.

A man who has satisfactorily served as Machinist, Engineer, and Draughtsman, is desirous of securing a position. Terms moderate. Highest references. Address L. L. Duerden, 3d Ave., between 35th and 36th Sts., Brooklyn, N. Y.

Transits and Levels, second-hand, wanted. Send size, and name of maker, to Keuffel & Esser, New York.

Lightning Screw Plates and Labor-saving Tools, p. 380.

For Sale.—1 Engine Lathe, Fitchburg, 7½ ft. x 15 in.; price, $250. 1 Iron Planer, planes 7½ ft. x 34 in. x 30 in.; price, $550. Address Concord Axle Co., Fisherville, N. H.

Workshop Receipts.—A reliable Handbook for Manufacturers and Mechanics. $2, mail free. Ornamental Penman and Signwriter's Pocketbook of Alphabets. 20 cents. E. & F. N. Spon, 446 Broome St., New York.

Presses & Dies (fruit cans) Ayar Mach. Wks., Salem, N. J.

Mailed free. Catalogue of Books for Engineers. Theoretical and Practical. E. & F. N. Spon, 446 Broome St., New York.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock, 80 to 88 Market St., Chicago, Ill.

Telegraphic, Electrical, and Telephone Supplies, Telegraph Instruments, Electric Bells, Batteries, Magnets, Wires, Carbons, Zincs, and Electrical Materials of every description. Illustrated catalogue and price list, 72 pages, free to any address. J. H. Bunnell & Co., 112 Liberty St., N. Y.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Abbe Bolt Forging Machines and Palmer Power Hammers a specialty. S. C. Forsaith & Co., Manchester, N. H.

Foot Lathes, Fret Saws, 6c. 90 pp. E. Brown, Lowell, Mass.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Punching Presses & Shears for Metal-workers, Power Drill Presses, all sizes. Power and Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N. Y.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

The Best constructed low priced Engines are built by E. E. Roberts, 107 Liberty St., New York. Communicate.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited. Erie, Pa.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Improved Skinner Portable Engines. Erie, Pa.

Learn Telegraphy. Outfit complete, $4.50. Catalogue free. J. H. Bunnell & Co., 112 Liberty St., N. Y.

List 27.—Description of 3,000 new and second-hand Machines, now ready for distribution. Send stamp for same. S. C. Forsaith & Co., Manchester, N. H., and N. Y. city.

Ajax Metals for Locomotive Boxes, Journal Bearings, etc. Sold in ingots or castings. See adv., p. 365.

The Sweetland Chuck. See illus. adv., p. 366.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor, Stiles & Co., Riegelsville, N. J.

Skinner's Chuck. Universal, and Eccentric. See p. 365.

For Machinists' Tools, see Whitcomb's adv., p. 366.

Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 382.

4 to 40 H. P. Steam Engines. See adv. p. 382.

Peck's Patent Drop Press. See adv., page 398.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

Ball's Variable Cut-off Engine. See adv., page 396.

Paragon School Desk Extension Slides. See adv. p. 397.

Brass & Copper in sheets, wire & blanks. See ad. p. 398.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Cope & Maxwell M'f'g Co.'s Pump adv., page 398.

Machine Diamonds, J. Dickinson, 64 Nassau St., N. Y.

Wanted Agency for the Sale of Patented Goods suitable to the manufacturing districts and shipping ports of England and Wales. Address W. H. Essery, Swansea, England.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Eagle Anvils, 10 cents per pound. Fully warranted.

Geiser's Patent Grain Thrasher, Peerless, Portable, and Traction Engine. Geiser Mfg. Co., Waynesboro, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 397.

For the manufacture of metallic shells, cups, ferrules, blanks, and any and all kinds of small press and stamped work in copper, brass, zinc, iron, or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small wares, notions, and novelties in the above line, a specialty. See advertisement on page 398.

Walrus Leather, Walrus Wheels, Emery, and Glue for Polishers. Greene, Tweed & Co., 118 Chambers St., N. Y.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 396.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

New Economizer Portable Engine. See illus. adv. p. 398.

Lathes, Planers, Drills, with modern improvements. The Pratt & Whitney Co., Hartford, Conn.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Saw Mill Machinery. Stearns Mfg. Co. See p. 397.

Common Sense Dry Kiln. Adapted to drying all of material where kiln, etc., drying houses are used. See p. 398.

Supplee Steam Engine. See adv. p. 397.

Don't buy a Steam Pump until you have written Valley Machine Co., Easthampton, Mass.

Blake's Belt Studs. The strongest fastening for old and new belts. Greene, Tweed & Co., 118 Chambers St., N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) S. W. M. asks: 1. What is tea chest lead solder composed of? A. The solder used is said to be composed of 2¼ of lead and 1 of tin fused together. 2. Which is the strongest: two pieces, 2x6, spiked together, or one piece, 4x6, solid? I contend the latter; a friend, the former. A. The latter is the stronger.

(2) M. T. asks: Can you inform me whether glass is now manufactured in a spun state tough and malleable? A. Glass fibers such as you describe have not yet been produced. From the nature of the substance it is not likely that a malleable glass can be produced.

(3) M. A. M. asks: 1. How can I make a flour paste that will not sour? A. You will find good receipts for pastes under Cements, etc., in SUPPLEMENT, No 158. 2. Have you ever published anything on newspaper stereotyping—how to prepare matrix and paste for that purpose? A. See the stereotype process, page 4938, SUPPLEMENT, No. 310.

(4) R. R. asks: Can you give the usual proportions of glue, sirup, and glycerine used in making printer's rollers? Also, can you suggest any remedy to make the rollers less tacky or possess less suction in moist, humid weather? A. A good printing roller is prepared as follows: Weigh out equal quantities of good white glue and concentrated glycerine. Soften the glue by soaking it in a small quantity of soft, cold water over night, then heat it over the water bath (a strong salt water bath is preferable) with occasional stirring for five hours. Have the moulds (brass) well oiled, and give the composition plenty of time to harden in them. In stirring avoid beating air bubbles into the composition.

(5) T. H. J. asks: 1. How can I deposit a thin coating of copper on soft metal plates? The plates are composed of lead, tin, and type metal, and are about one-sixteenth inch thick and 1⅞ inch diameter. I wish to face them with copper on one side only. Can you tell me how to prepare the solution? A. Coat the parts not intended to receive a deposit with wax or asphalt varnish; wind a copper wire tightly around the edge of the plate, so as to make a firm electrical connection with the metal; then clean the surface by submitting it to the action of the wire scratch brush, and immediately connect with the wire proceeding from the zinc plate of the battery, and immerse in the following bath, facing but not touching a plate of clean copper, connected by wire with the copper or carbon of the battery. The bath may be composed of a solution of 2¼ pounds of pure sulphate of copper in a gallon of soft water. The water is first heated, the copper salt dissolved in it, and the bath allowed to cool before using. 2. Also, describe how to construct a cheap battery. A. For details of the construction of batteries see SUPPLEMENTS, Nos. 157, 158, and 159.

(6) F. P. S. asks: 1. Can the magneto-electric machine, described in No. 23, SCIENTIFIC AMERICAN, be used for plating small articles of hardware? If so, would it want to be arranged for "quantity" or "intensity?" A. Yes, for quantity. 2. Does hydrogen gas, when mixed with air, form an explosive compound? A. Yes. 3. If so, what proportion of each is necessary for the most marked results? A. For the pure gases, two volumes of hydrogen and one of oxygen, at the same temperature. 4. Is the explosion of the nature of a collapse or an expansion? A. The temperature accompanying the reaction momentarily expands the aqueous vapor formed beyond the volume of the mixed gases used, and the result is an explosion, not a collapse. 5. What is the explosive force per square inch? A. We have no data at hand on this point. It depends greatly upon the conditions—temperature, pressure, etc.

(7) J. A. B. asks: What is the best kind of oil or oils, or ingredients with oil, to use on canvas tents or wagon covers to make them waterproof? I have used linseed oil and beeswax, but the odor from it in summer is very unpleasant, and in winter it freezes so easy that you cannot handle it without first thawing out, as it will all break to pieces just like glass. What I want is something that will leave it pliable, have as little odor as possible, and will not mildew when rolled up wet or stick together in warm weather. A. You will find the information required under Waterproofing, page 81, vol. xlv.

(8) E. M. asks: 1. Will a furnace grate made of pipe for heating water and making steam get coated and stopped up with lime or other impurities in the water if a constant and forced circulation is maintained? A. If the water contains much lime it would gradually deposit and eventually choke the pipes. 2. If so, is there anything that can be put into the water that will prevent it and keep the pipes clean? I propose to supply my grate with water by attaching to the city water pipe, which will furnish a pressure of 40 pounds to the square inch. A. An examination to ascertain the precise nature of the impurities contained in the water would be necessary to properly answer the question.

(9) G. D. asks: What is the best process for melting platinum on a small scale? I cannot get up heat enough to melt it with charcoal fire. Do you know of a book published on compounding metals that would give the information? A. Platinum is melted in flat lime crucibles in the flame of a blowpipe fed with oxygen and hydrogen. It cannot be melted in any ordinary furnace. For books on metallurgy see addresses of bookdealers in our advertising columns.

(10) D. J. F. asks: How can I make a white ink that will write on black paper or card; and also, how to make a good black ink suitable for card writing? A. You will find good receipts for white and black ink in SUPPLEMENT, No 157.

(11) L. J. asks: Can an iron railroad tie, in your opinion, be made practicable? A. Yes; iron ties are in use.

(12) M. J. K. asks: 1. Can you give me a receipt for making a quickly drying polish or varnish to be applied to small turned articles while in the lathe? I want a hard and glossy surface. A. Dissolve ten ounces shellac in one gallon of wine spirit by gently heating over a water bath and stirring. Let it stand for several days in a covered vessel, then draw off the clear portion from any sediment, for use. 2. Can you give me some method of ebonizing articles of this kind? A. Put the wood for about half an hour into a hot solution of one ounce of logwood extract in a quart of water, and then transfer to a warm solution of one pound of copperas in a gallon of soft water, and let it remain in this bath for several hours. Give the pieces a second dip in the logwood and iron liquors, then rinse and dry.

(13) J. W. C. asks: 1. Will you please give receipt for making a stove polish paste that can be put on a stove when hot or cold, and will give a good polish without much friction? A. Reduce pure graphite to finest flour by grinding it in the moist state. Then mix into a stiff paste with a sufficient quantity of hot water in which has been dissolved perchloride of iron in the proportion of a quarter of a pound chloride to the gallon of water. Let it stand, with occasional stirring, for two weeks before using it. A few drops of oil of almonds or cloves may be added to the paste to cloak any unpleasant odor. 2. Please give me directions for making the liquid insulation that I find on wire on Ruhmkorff coil. Think it is varnish, or something similar. A. Use ordinary alcoholic shellac varnish mixed with enough vermilion to give it a suitable color.

(14) N. J. S. writes: At present the hemp, binder's twine, passing through the spindles of our balling machines, cuts the edges of the hole in deep grooves. The hardest steel bushings are soon cut, and the twine is thereby injured. As an experiment, we want to countersink a porcelain "pot-eye" in the bushing, to obviate this cutting, if possible. What cement will secure this pot-eye in its place, fastening porcelain to iron? A. You had better try some mechanical method of securing the porcelain on the iron; cement cannot always be depended on for such a joint. You can try the following cement: Melt together in an iron vessel over a moderate fire gutta percha and shellac in about equal proportions, and stir well together. Use hot.

(15) H. L. asks: What is meant by the expression "level of the sea?" A. It is the average level of the water of the ocean where it touches the land.

(16) T. S. asks how two pieces of broken cast iron can be soldered together. A. See answer to A. G., on this page.

(17) A. G. asks (1) how to solder brass and iron together with soft solder. A. Dissolve zinc in muriatic acid until action ceases. Reduce with water, and apply to the surfaces to be soldered. If the brass and iron are clean there will be no difficulty in soldering them together with a soldering iron or blowpipe. 2. How is the wipe lead joint made? A. See Plumbing, in SUPPLEMENT 309.

(18) O. W. B. asks: How can I get a gold plate off a silver watch? A. If the plate is thin dip it momentarily in a little mercury and rub with a piece of soft chamois leather. Repeat the dipping (in fresh mercury) several times or until the gold color has been removed. Then heat the case until the film of mercury adhering to the silver has been dissipated. The mercury should not be allowed to remain too long in contact with the silver. The case should, of course, be separated from the works before being operated upon.

(19) D. H. D. asks: 1. What kind of carbon is used in Blake's transmitter used in connection with the bell telephone? A. Hard electric light carbon. 2. What kind of spring holds it in contact with the diaphragm of the transmitter? A. A piece of watch spring. 3. Is the diaphragm used in Blake's transmitter the same as that in the bell receiver? A. No; it is thicker. It is made of ordinary Russia stove pipe iron. 4. Why are not the Blake and Edison transmitters virtually the same, as the varying conducting power of the carbons under different pressure seems to be the principle on which both act in the telephone? A. The action is about the same when the Blake is working normally. 5. In what number of the SCIENTIFIC AMERICAN is Blake's transmitter fully described? A. SCIENTIFIC AMERICAN SUPPLEMENT, No. 250.

(20) G. F. M. writes: I am making a small magneto electric machine of the Clarke pattern, only with this difference: I intend to use two armatures, one on each side of the exciting magnet. What I wish to know through your correspondents' column is: Cannot I use an electro-magnet instead of permanent horseshoe magnets, and pass the current from the armature coils through its coil from the commutator before using it on the outside for work the two armatures will be set at right angles to each other. A. You can arrange the armatures and magnets as you propose; but for a very small machine permanent magnets are to be preferred to electro-magnets.

(21) D. C. asks: Do you know of any comprehensive tabular statement of liquids generally showing their specific gravity, specific heat, boiling temperatures, ratio of expansion upon being converted into steam under the ordinary pressure of the air, and caloric of fluidity of steam; or does there exist materials for compiling such a statement readily? A. Consult "The Constants of Nature," part I., published by the Smithsonian Institution, Washington, D. C.

(22) S. E. writes: Some time ago we put a set of condenser pipes on our launch which lasted only about five months. The pipes were made of some kind of brass or copper composition, 1¼ inch, tin lined. Fearing they would give out at any time we replaced them with a set of galvanized iron ones, 1½ inch; but they only lasted about four months, being completely honey-combed, as were the others, as far as the tin lining. We then replaced the second lot of pipes with the first set, having first given them a coat of a mixture of tar and asbestos, filling all the holes well with the mixture. Now we are in a fix. The pipes are of no use to us, for they will not condense. They worked very well before we covered them. What is wrong, and what kind of pipe should we use, and how long should a set last on our launch, which is covered with yellow metal? The launch is used only eight months of the year, the balance of the time at anchor. A. Copper or tinned copper pipes are the best for condensers. They are less affected than brass or iron. Asphaltum is a very poor heat conductor, hence the failure of the coated tubes. no varnish or enamel is admissible.

(23) W. E. F. asks: Why does solder melt under the soldering "iron," when it will not under real iron, and why is it necessary to have the tool coated with tin? Does it act as a flux? A. Solder will melt under any hot iron, but unless the iron (or other metal) is perfectly free from oxide, perfect contact between the melted solders and the "iron," which is essential, cannot occur. When properly cleaned and coated with tin (or solder) the coating prevents reoxidation of the metal while heating, and the fluid metal follows and can be directed by the tool.

(24) C. W. G. asks: What can be used for blacking scraps of upper leather on the grain side? It must be something that will not smut when dry, and do the work with one application. A. Dissolve one pound of good sulphate of iron in two quarts of warm soft water. It may be applied with a brush or by dipping.

(25) C. and S., of Halifax, N. S., write that they are driving a lot of sewing machines and a Siemens electric light machine with a five horse power caloric engine. They secure uniform motion by applying a four-foot balance wheel to the countershaft of the electric light machine, and say that the light is steady.

(26) C. E. R. writes I am thinking of having a "secondary battery" made for experimental purposes, and wish to ask if you can give or direct me to any lately acquired knowledge relative to its construction? A. We believe the latest thing in this line is to confine the minium in folds in the lead plates. Woolen flannel as a separating medium is preferable to cotton fabrics.

(27) S. M. asks: Can you inform me how the frosted appearance is given to new silver goods, such as bracelets, broaches, cups, portions of claret jugs, etc., and how I can make some coarse and others finely frosted, according to the article, be it large or small? I should also be thankful if you can give me the same information concerning 18 carat gold. I have often desired a frosty appearance on masonic and other jewels, and for lack of which my make of jewelry very considerably falls short of finish. I have tried several acids mixed, but with only a sprinkling of success, never approaching near to the frosted appearance I see

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on manufactured goods from England. I have also tried experiments with the points of scratch brush; also the positive end of a battery, with the goods hanging in a cyanide solution. This last gave me the best results, but is evidently not the thing. A. A "dead luster" is imparted to articles of copper or copper alloy by dipping them for a few minutes in a bath composed of—

Nitric acid (36°)	20 pounds.
Sulphuric acid (66°)	10 "
Salt	½ pound.
Zinc sulphate	1/10 "

Mix the acids gradually, add the zinc salt, then the salt, a little at a time (out-of-doors to avoid the acid vapors), stir well together, and let it get cold before using; rinse thoroughly, and pass through the cyanide before putting in the plating bath. When such a surface is plated with silver it presents the frosted appearance required. Dead luster gilding is produced by the slow deposition of a considerable quantity of gold, by giving the metallic surface a dead luster before gilding (by means of acids), by first preparing a coating of frosted silver or by depositing the gold upon a heavy copper deposit produced with a weak current in a bath of copper sulphate. See "Electrometallurgy," in SUPPLEMENT, No. 310.

(28) O. P. inquires for a simple method of preserving iron surfaces without paint. A. Captain Bourdon has devised simple forms of apparatus for coating iron with Barff's magnetic lacquer. In the course of his experiments he found that the coat of oxide could be formed by the air in the following manner: The serpentine part of a sheet iron reservoir communicates with air which is heated to 248° Fah. The current of hot air, after circulating through the serpentine, reaches the cylinder which contains the articles to be lacquered. The escape spout communicates with a water aspirator regulating the flow of air, which should be very gentle. The internal pressure is little more than one atmosphere, the apparatus being in communication with the open air. The temperature of the air in the cylinders is 536° Fah.; the operation lasts five hours, giving a coat of 0·05 of a milimeter thick (0·002 inch), of a beautiful greenish black, resisting the action of fine emery paper and of dilute sulphuric acid. After the articles are taken from the cylinder they are rubbed with a greasy rag, and spots are removed by fine emery paper or scouring grass. Spots may generally be avoided by suspending the pieces, so that they will not touch each other or the walls. If the temperature is raised to about 572° Fah., a thick coat is secured, but it is apt to scale. Articles thus lacquered have been exposed to snow and rain for a month without getting any spots of rust. If the black coating is removed by emery paper, there is a grayish layer on which rust does not take much hold; the spots can easily be removed by a bit of hard wood. Barff has observed the same peculiarity in articles which have been steam-lacquered.

(29) E. M. B. writes: Will you please inform me, under Notes and Queries, of one or two best modern books on steam boilers? A. "Barr on Steam Boilers;" "Catechism of the Locomotive," Forney; Wm. H. Shock, U. S. Navy, on "Boilers;" "Heat and Heat Engines," by Trowbridge.

(30) N. S. asks: Would it pay to work a mine of pure mica, if in large sheets, with say $15 or $20 freight per ton to San Francisco? A. See article on Mica and its Utilization, page 257, current volume.

(31) W. G. R. writes: In the SCIENTIFIC AMERICAN, dated December 14, 1878, on page 371, you describe a small foot lathe with directions for making the same. If the holes, instead of being babbitted, are bored, and the bars forming the shears are turned, and I should make my own turning and boring, what do you think would be the probable expense of making such a lathe? A. The materials would cost from $5 to $6.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

N. F. W.—It is a silicious clay of fair quality. An analysis such as you require would cost $5.

[OFFICIAL.]

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Letters Patent of the United States were Granted in the Week Ending

November 22, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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Compositors' rule, L. K. Johnson, Brooklyn, N. Y.
Eggs, preserving, K. H. Loomis, New York city.
Moulded metallic bodies, W. H. Mallory, Bridgeport, Ct.
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Railway signaling apparatus, J. B. Johnson, Boston, Mass.
Slide valve, W. B. Turman, Waldron, Ark.
Torpedoes, W. H. Mallory, Bridgeport, Conn.

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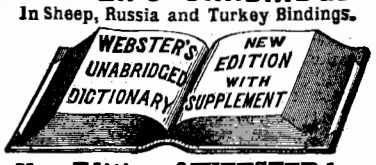

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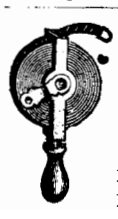

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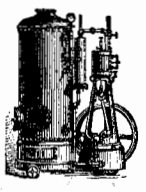

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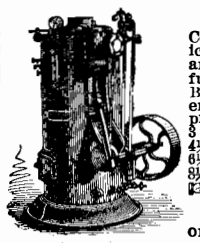

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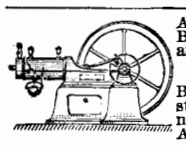

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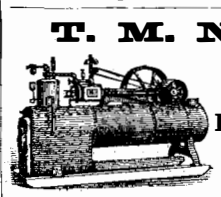

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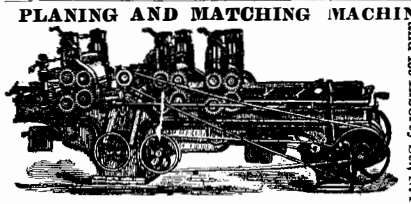

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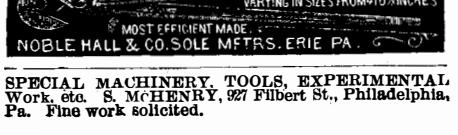

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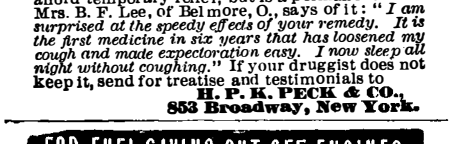

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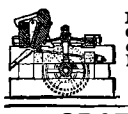

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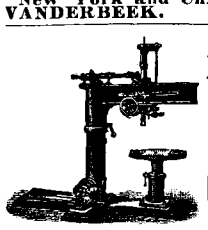

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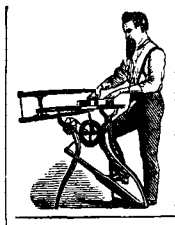

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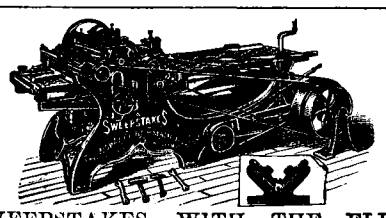

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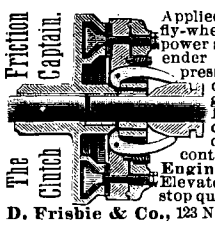

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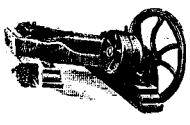

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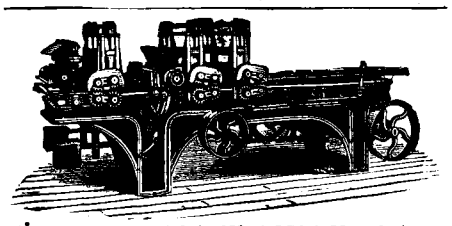

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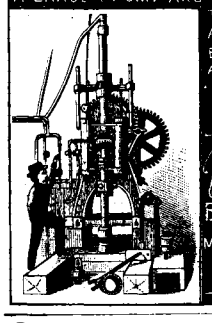

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